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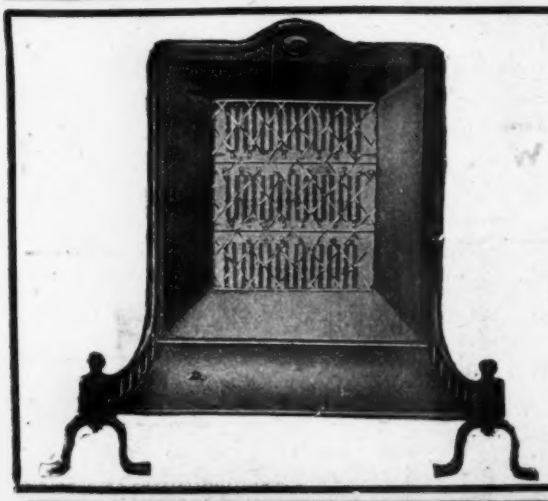

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ELECTRICAL REVIEW.

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MERE MECHANISM.

PROFESSOR ARTHUR DENDY, speaking before the Eugenics Education Association on the 14th inst., remarked that we had approached very near slavery to "mere mechanism," and he proceeded to question the advantages of science and mechanical progress from the point of view of humanity; he appears to have come to the conclusion that primitive conditions were superior. In fact he seems to have spoken as though the disfigurement of the country by railway tracks and slag heaps, the use of motor cars, aeroplanes, tube trains, and the provision of "gin palaces," and crowded theatres, could be lumped together in a heap as one great curse, and abolished with advantage to the human race.

We have not forgotten the remarks of that great teacher, Ruskin, in a somewhat similar strain in condemnation of railways and other apparatus which interfered with the enjoyment of Nature. And we recall a remark of another philosopher, John Stuart Mill, who declared that all the improvements of civilisation had not lightened the toil of one human being.

These sporadic attacks which are made from time to time, by great thinkers, upon the advancement of science, are in our opinion misdirected.

The real fact is that the only lines upon which advancement of the human race is at present discernible are the lines of scientific research, discovery, and mechanical application. In no other branch of human activity have such results been obtained. Improvements in systems of Government, and in morals and manners, appear to be considerably less rapid.

The gifts which science has presented with both hands to humanity since James Watt put steam engineering upon a scientific basis, and which are, generally speaking, within the reach of the mass of civilised populations, are such as ancient kings and princes would have given one-half of their kingdoms to obtain. To say that all human labour has not thereby been reduced is to state what is not correct. The inventions and improvements of the last hundred years have increased the potential productivity of every human being tenfold, while at the same time lifting from him many of the heaviest burdens of labour altogether, and generally increasing his comfort, improving his prospects, and enlarging his leisure.

Unfortunately, it must be confessed that the improvement is nothing like what it might have been, and what it ought to have been. The scientific men and the engineers have done their part, and have produced actual results which can be repeated indefinitely, and which they still improve upon from day to day, in transport facilities, means of communication, cultivation and production of every necessity of life, even in apparatus for educational purposes.

But having produced these things, unfortunately their control ceases, and the management is taken over by a horde of politicians, lawyers, profiteers, and careerists, whose capacity for self-advancement and self-advertisement is in inverse ratio to their scientific knowledge. It is the bad management and unfair distribution of all these benefits, provided by the modest and silent slaves of science, which have produced the slums and the waste, and the wars which from time to time burn up in one vast conflagration all the accumu-

lated stores of wealth and welfare produced by the previous generation.

Ruskin and John Stuart Mill and Prof. Dendy and many others would have been better employed in attacking the persons who are responsible for the management of our affairs, than in depreciating the solid achievements of the real makers of civilisation. If imagination on the part of modern philosophers is occasionally a little lacking, we would suggest that it might be stimulated by healthy exercise undertaken, not with the primitive tools which preceded the age of steel (for that might be carrying their argument too far), but with the very best hand tools which can now be obtained. They might get a little coal without the assistance of winding engines or fans; or if they objected to coal-getting, as a dirty and unnecessary operation, they might cut up their daily ration of wood fuel with a hand saw. A trip across the Atlantic in a 50-ton sailing ship would provide a useful holiday, and a walk from Land's End to John o' Groats would enable them to see a lot of country unspoilt by railways. Pumping water from a well, reading by the light of an oil lamp, and communicating with their friends by means of letters carried by a servant on horseback, would also assist them in going right back into the good old times.

In our opinion, it is unfortunate that scientific and practical men have so little to do with the control of the world's affairs, and we are convinced that little improvement will be made until such men are not only occasionally called into council to deal with emergencies, but are placed in positions of power and responsibility. The blame for the present chaos lies entirely with men who could be classed as non-producers; it is they who make war, and what sometimes appears almost to be worse, who make peace. They stand in the way of the practical man, sometimes in single powerful units, sometimes in committees and battalions, but it is always they who postpone action until too late; who spend, in waste and foolishness, the money that ought to be used in reaping the harvest field of labour; who then turn round and blame the advancement of mechanical science. It is as though the producers presented them with a beautifully-finished motor car capable of running on the road at 40 miles an hour: and they jump in and proceed to drive it over the cliff at Beachy Head. Then, when the survivors contemplate the results, they blame the car and its makers.

Engineers' Clubs.

The proposal to form an Engineers' Club for London, on lines similar to those on which the Manchester Club has become so firmly established, is making good progress; many names have been sent to the engineering Press in support of the scheme, and preliminary steps have been taken towards the formation of a provisional committee to carry out the project. While the support already received gives good reason to believe that success is practically certain, we earnestly request those in favour of the establishment of the club to forward their names without delay, to us or any of the engineering journals. To those who have already written to us we offer our thanks, and beg them to accept this acknowledgment for the moment; they will be placed in communication with the organising body when it is formed.

It is interesting—and heartening—to know that an engineers' club is actually in course of establishment in Birmingham, and that so much progress has been made that an option on suitable premises has been exercised.

With regard to the London club, it is generally agreed that sleeping accommodation is a *sine qua non*, for the comfort of the very numerous country members who are certain to join in. A central situation is also a cardinal feature of a satisfactory scheme. It is clear, therefore, that the plans must be laid on an ambitious scale, in order to command success. On the other hand, with a sufficiently large membership there should be no insuperable difficulty in carrying out the project, which would have the great advantage of a good "load factor," as the *Electrician* has aptly pointed out, owing to the large number of visitors from the provinces who would maintain a continuous demand on the resources of the club, not only during the day but also in the evening.

We shall keep our readers informed as to any developments that take place, and again invite them to signify their support—which, of course, does not commit them to any liability whatever.

Electric-Supply Agreements with Local Authorities.

There are certain cases where electricity supply companies are parties to agreements with their local authorities by which they agree not to charge the ordinary consumer above a certain price per unit. In the abnormal circumstances of the last few years many companies have obtained statutory orders to increase their maximum price, and such price has been usually above the agreed amount. The companies affected, therefore, have been unable to take advantage of the higher statutory price because the agreement with the local authority has stood in the way.

A case has recently been tried in which an agreement of this kind came up for review. Although this was reported (in our issue of November 5th last), it is doubtful whether it has received quite as much attention as it should. It was particularly important, since the County Court gave judgment first in favour of the consumer, and later on the High Court on appeal reversed it. In giving the judgment, it was held that the consumer was no party to the agreement in the sense that he could set up the contractual provisions as a reason why he should not pay the price authorised by the Electricity Commissioners. In legal parlance, the agreement was held to be in the strictest sense *res interalios acta*. It was apparently supposed by the local should charge private consumers. The Court held, however, that the Corporation had no trust towards its individual burgesses to do any such thing; it could not be argued that the agreement was an answer to the statutory demand of the company against the consumer. *Primâ facie*, therefore, this verdict would seem to be a very valuable one for any other companies which are in the same boat as the Carmarthen Co. in this respect.

The Telephone Report.

The report of the House of Commons Select Committee on Telephone Charges, which was issued last week, is abstracted elsewhere in this issue. In substance it does not differ greatly from what was anticipated. The flat rate for unlimited service has gone for good, together with the "measured service" rate, leaving only the rational and just message-rate. The Committee, in fact, has decided that the payment shall be in proportion to the value of the service rendered, precisely in accordance with the principle of "payment by results," which is regarded by economists as the right and just system of works management.

Already the continued advance in wages of employés since May last has swallowed up the estimated balance of £800,000 for the first year, and consequently there will be a deficit in the second and succeeding years if the Post Office estimates are realised. It is to be hoped that this may be met by economies rather than by a further increase in the tariff—though this is indeed a forlorn hope.

We are pleased to see that the Committee recommends the extension of research, and the liberal reward of inventive genius. When we contemplate the vast scale on which our American friends conduct their telephone research, we almost despair of the possibilities of research on the very limited lines of a Government department in peace time. However, the public insisted on nationalising the telephone service, in spite of our warnings, and must lie on the bed it has made.

THE QUALITY OF INDUSTRIAL COAL SUPPLIES.

By J. S. EVENDEN.

Whatever may be said for or against the methods adopted by those responsible for the management of the British coal mining industry, it is a well recognised fact that industrial users of coal for steam raising and general manufacturing processes are experiencing increasing difficulty owing to the almost wholly unreliable and inconsistent nature of their coal supplies, and this difficulty has certainly become more pronounced now that the output of coal only barely meets the country's requirements.

The possibility of reorganising, standardising, and generally improving the methods employed in the preparation of coal for the consumer does not appear to be an attractive proposition to the colliery proprietors, and the consistent manner in which they have always disregarded the testing and analysis of their product strongly suggests that they prefer the ton to the British thermal unit as a selling basis.

There is no other industry, even approaching the importance of coal mining, where such indifference to the quality of the marketed article has been displayed. Steel manufacturers, iron founders, cement manufacturers, and the like all devote the closest possible attention to the analysis and value of their products, and it is common practice to furnish the customer with guarantees based upon actual tests carried out by, and at the expense of, the manufacturer; but the colliery people have never been in a position to give any satisfactory guarantee as to the minimum calorific value or maximum percentage of ash which the consumer might reasonably expect his deliveries to show; indeed, it is not uncommon to meet colliery agents and coal merchants who are unable to define a British thermal unit, and are completely ignorant as to the significance of a proximate analysis.

To afford some protection against this unfortunate state of affairs, it has been the practice of large consumers to obtain the necessary apparatus and employ assistants in order that they may, from time to time, ascertain the calorific value of the coal which they receive, but although this information provides a basis for calculating the efficiency of the plant, it has no influence upon the quality of the deliveries, as unsatisfactory fuel cannot very well be rejected, and the strongest protest has very little effect upon the colliery people or their merchants.

Many thousands of tons of coal containing anything up to 35 per cent. of ash are dumped daily upon the consumers of London alone, and when it is remembered that this useless material is conveyed an average distance of, say, 130 miles, and that when it is received it limits the output and impairs the efficiency of costly plant, increases the operating costs, and involves special machinery and additional labour and expense for its subsequent removal, it is not an exaggeration to say that in its effect upon transport and the efficiency of industry, the question of improved coal supplies is one of fundamental national importance. It has become common practice for the chairmen of colliery undertakings when addressing their shareholders to dwell upon the sins of the Government and the Miners' Federation, and their grave effect upon colliery finance; there is seldom, however, the slightest reference to the requirements of the coal consumers, or the very real need for reformed methods of washing, grading, and standardising supplies.

Assuming the colliery industry as a whole to be controlled by men who regard the well-being of the country as worthy of consideration, it should not be difficult to effect a very big improvement in the preparation and distribution of industrial and domestic coal supplies.

Each colliery would require a properly equipped laboratory and the services of a qualified fuel analyst, whose whole time would be devoted to continuously testing and recording exact particulars as to the value of the output of each grade of coal. This information would be of the utmost value to consumers and the collieries could be called upon to furnish the test results from time to time when forwarding invoices or accounts, and when accepting a contract they would be in a position to give a reasonable guarantee as to the class and quality of coal which would be supplied. The whole of the test results and the method of sampling and testing should be open to inspection at any time by qualified Board of Trade inspectors, and it might be found desirable to establish penalties which would be imposed where it was found that any coal had been dispatched from the pit containing an excessive amount of non-combustible matter, or otherwise falling below standard values which might be established with due regard to the location of the consumer and the character of the pit which was being worked.

The establishment of laboratories at the collieries would provide information which would be most valuable to some 50,000 industrial coal consumers, a very small proportion of whom are able to undertake the work, the majority being, therefore, utterly at a loss to determine the efficiency of their plant, and entirely at the mercy of the colliery proprietors in the matter of the quality of the fuel with which they are supplied.

Prior to the flat-rate increases imposed during the war period upon all grades of fuel, the price of fine and nutty slacks was such that the heat value per unit of cost gave an apparent advantage in favour of endeavouring to use low-grade fuel containing a high percentage of ash, and since the total supply of coal is now only approximately equal to the demand (even with limited exports) many consumers must of necessity continue to use low-grade fuel, although any advantage in the matter of price has long since vanished.

The utilisation of low-grade fuel is, therefore, still boomed by manufacturers of mechanical draught and stoker plant, and in consequence, it is still believed to be a praiseworthy and profitable achievement to accept and pay for 30 tons of useless rubbish in every hundred tons delivered; the full effect of this costly encumbrance is seldom considered, and it is safe to say that the national question of useless and utterly wasteful haulage which it necessitates is practically dismissed as of no importance.

Assuming the scientific reorganisation of the coal industry to be desirable, it should be a simple matter to bring about an enormous improvement in the average calorific value of industrial coal supplies by introducing improved and standardised methods of screening and grading, washing, and testing, and while it is admitted that there must always be a considerable residue of culm, dross, slurry, and other varieties of colliery refuse, it should be possible to prohibit the utilisation of this material at great distances from the pits by arranging for its consumption by power stations, briquetting works, and carbonisation plants in, or near, every important colliery zone, thereby avoiding the senseless haulage of useless material over long distances.

After all, the purchaser of coal for every purpose really requires thermal units, and the most carefully considered arguments, or elaborately presented test results, cannot possibly justify the acceptance of a high percentage of non-combustible material if it can be shown that it is commercially and scientifically possible to reduce the ash content to reasonable proportions. This is more obvious than ever now that the additional plant and labour which the use of low-grade fuel involves is so much more costly to provide, and it is high time that the consumers realised this and brought suitable pres-

sure to bear upon those responsible for the present state of affairs.

There is a grave danger that in pushing for increased output from the collieries the question of quality will be overlooked, and in this connection the Press and the public will be well advised to reserve some of their criticism for those who control the mining industry instead of concentrating it all upon the operatives.

SYNTHETIC INSULATING MATERIALS.

Artificial Silk.

By R. W. KENNEDY.

The recent Government contract schedule for internal telephone wire, which specified that "cellulose silk" (not nitro or "wood silk") might replace real silk as an insulating material, serves to direct attention to recent developments in the artificial silk industry, which should be of the utmost importance to the electrical world.

The "cellulose silk" industry in this country has grown out of our aerial needs during the war. One of the early "dopes," or covering varnishes, applied to tauten and protect the fabric on aeroplane wings, consisted practically of a solution of celluloid (nitro-cellulose) in acetone. A film of this material when applied to fabric and allowed to dry, has the property of contracting and thus tautening the fabric drum-tight on the aeroplane wing or fuselage.

As is well known, however, ordinary nitro celluloid (made by the action of nitric acid on some convenient form of cellulose, such as cotton wool) is highly inflammable; and the introduction of a non-inflammable celluloid made from acetyl cellulose, or cellulose acetate, provided a non-inflammable dope film, which was exclusively used on our fighting machines during the later years of the war.

Since, however, this non-inflammable celluloid also possesses important electrical properties, and since recent research has proved that the material is capable of providing an excellent quality of artificial silk, its prospective utility under peace conditions would appear to be even greater than its undoubted importance in connection with the war.

With regard to the use of cellulose-acetate artificial silk for insulating purposes, a number of interesting tests have been carried out at the National Physical Laboratory, Teddington, on behalf of the British Cellulose and Chemical Manufacturing Co., of Spondon, Derby. Two samples of No. 18 S.W.G. copper wire were supplied, one being covered with spun cellulose-acetate, and the other with ordinary silk insulation.

The thickness of the spun cellulose-acetate covering was found to be 0·2 mm., and that of the silk 0·06 mm. Three coils, A, B and C, each with from 40 to 50 turns, were made up on brass tubing 1 in. in diameter:—

A, with covered silk wire; B, with spun cellulose-acetate covered wire; and C was a coil similar to B, but dipped in a solution of cellulose-acetate in acetone and chloroform.

The insulation resistance between the wire and the brass tube was measured with a pressure of 250 volts, and the results are given below in ohms or megohms per turn:—

Temp. C.°	Humidity. Per cent.	Insulation resistance per turn. A.	B.	C.
20	0 (from desiccator)	35,000,000 megohms	170,000,000 megohms	300,000,000 megohms
20	40	180,000 megohms	2,500,000 megohms	10,000,000 megohms
20	100 (saturated)	60,000 ohms	400,000 ohms	74 megohms

The coils A, B, and C were then tested for insulation resistance under various conditions of temperature and also after immersion in water. The insulation resistance between the wire and the brass tube was measured with a pressure of 250 volts, and the results are given below in megohms per turn:—

Temperature.	Insulation resistance per turn. A.	B.	C.
30° C. ...	950,000	24,000,000	46,000,000
50° C. ...	11,000,000	67,000,000	320,000,000

These observations were in each case taken after the coils had been exposed to the specified temperature for about 24 hours.

The coils were then immersed in water for an hour, and the insulation resistance measured: (1) Immediately after being taken out of the water; and (2) after drying at ordinary air temperature for 48 hours. The following results were obtained:—

	Insulation resistance per turn. A.	B.	C.
(1) Immediately after immersion	0	0	0
(2) 48 hours after immersion ...	450,000	13,000,000	14,000,000

These figures speak for themselves and, at least, warrant the careful attention of electrical engineers who happen to be concerned with the use of silk as an insulating material.

The story does not, however, end here, since the cellulose-acetate "dopes," or varnishes already referred to, have important and useful electrical properties. Non-inflammable celluloid dissolved in suitable volatile solvents provides either thin or thick insulating varnishes for a wide variety of electrical purposes. Applied as insulating varnishes to armature and field coils, transformers, &c., the material is claimed to withstand heat, oils, gases, and acid vapours. The melting point of these varnishes is in the neighbourhood of 194° C., but at about 180° C. the material becomes plastic, although it suffers no other change.

Quite an interesting development of the insulating-varnish side of this material is to be found in the preparation of a paper insulating tape. For this purpose a coil of paper tape is mounted inside a tin box which is filled with cellulose acetate "dope," or insulating varnish, and, as required, strips of the paper tape may be pulled from the box, from whence it issues completely impregnated and covered with varnish ready for use. Such thin paper insulating materials have been found to break down under the following pressures: one layer, 250 volts; two layers, 660 volts; three layers, 2,700 volts.

Mention may finally be made of the value of non-inflammable celluloid for accumulator cases and as a general insulating material. Such sheets possess all the good qualities of ordinary celluloid, but, supremely important point, they are fire-resisting and non-inflammable even if strongly ignited in a hot flame. Non-inflammable celluloid sheets have a tensile strength of 286 kg. applied to a strip 2 cm. wide, the elongation being 55 per cent. Plates of the following thicknesses have broken down under the stated voltages:—0·2 mm., 13,200 volts; 0·25 mm., 15,800 volts; 0·35 mm., 22,000 volts; 0·45 mm., 25,000 volts; 1·0 mm., 26,000 volts; 1·3 mm., 31,000 volts; and 2 mm., 35,000 volts.

HOME LIGHTING ECONOMIES.

By "VOLTMAN."

Important as the advantages are which the tungsten metal-filament lamp has conferred on electric lighting, it has at least one disadvantage, which one might reasonably add to that of high initial cost, compared with the old carbon-filament lamp—namely, that it is impossible to obtain small units of light on the regular supply voltages of 200-250 volts D.C. The householder having an alternating supply is much better off, as he can at least use a small transformer for low-voltage lamps of 3, 5, and 8 C.P., and thus obtain these desired small units of light. The writer, whose house supply voltage is 230, once noted from a lamp maker's list that he could obtain an 11-C.P. lamp taking 15 watts. Buying one, as an experiment, by the time he got the lamp home, a distance of 10 miles, the exceedingly fragile filament had broken in three places, and bang had gone 3s. 9d. As some lighting economies had perforce to be effected, it became necessary to think out what could be done, as 20 or 30-watt lamps were too powerful and wasteful at a number of points. A look round sundry second-hand dealers' shops brought to light a few carbon lamps of 220 volts, and 6 and 8 C.P. Reckoning the con-

sumption at 3 watts per candle,* they were comparable with the lowest powered unit in tungsten lamps, but the real point in the economy of using them was that they only cost 6d. each, as compared with 3s. 9d. or 4s. for new tungsten lamps. The lamps of 20 and 30 watts which they replaced, were put in reserve for renewals.

Still on the search for further economies combined with efficiency, a simple plan was evolved to light a few inaccessible places and dark recesses where there is usually a risky tendency to use a taper or match. It is a plan that works well, and would seem capable of considerable application. A quite small and inexpensive 4- or 6-volt accumulator is connected in series with a convenient switch controlling two or three of the ordinary lights. A simple alteration to the switch always puts the accumulator on charge at a low rate whenever the lights are switched on. From the accumulator terminals a few circuits were tapped off, a length of flexible, a miniature switch, a lampholder, and a 4-C.P., 4-watt lamp being rigged up for each individual light, thus providing a useful and safe intermittent light just in those places where lights are never installed. The back E.M.F. of the accumulator does not appreciably diminish the main light on 230 volts.

Another point in lamp economy is that of utilising the self-repairing property of the tungsten filament. Never discard a burnt-out lamp without seeing if it will weld up by giving it a smart tap with the current on. The writer has had as many as four self-repairs on a 20-watt lamp before it was finally "dead," the extra life being estimated at 300 hours. These over-run lamps make a very fair substitute for "half-watts," and can replace two normal lamps during their short but merry existence.

THE TRADE SITUATION IN WESTERN EUROPE.

[SPECIALLY CONTRIBUTED.]

The effects produced in the shipping and dyestuffs industries by the payments already made, and to be made, by Germany in respect of her liabilities under the indemnity provisions of the Treaty of Versailles, are worthy of review. These effects, together with the allied considerations of the bearing on the situation of the rate of exchange between different European countries, and of the interchange of raw materials and of manufactured products between those countries, make it worth while to investigate the matter with a view to arriving, if possible, at a reasonably clear idea of what is required, what is taking place, and why what is (or was) required is not happening, so far as that is the case.

Wealth is goods, and money, even gold money, is merely a token. It cannot be eaten, or worn, or used to build houses, or to effect transport. Yet some of the talk during the war about making Germany pay, seemed to indicate the point of view that Germany would be called upon to send out 2,000 trains, each of 50 trucks, and each truck containing 10 tons of gold, the total coming to between 10 and 15 thousand millions of pounds sterling. This sum was to be divided among the belligerents responsible for Germany's overthrow, and an era of enormous business activity was to follow, the money being used to pay for British-built ships to replace those sunk during the war; to buy British coal for export to France and other countries needing it; and in general to pay for any raw or manufactured material required by any country (except Germany), and produced by any other country (except Germany).

Set down thus, the supposed view-point is manifestly absurd, and no one will be found to admit that he ever held it. Some will say that Germany was to surrender her stocks of raw material, others that Germany was to hand over manufactured articles which she was peculiarly qualified to produce. Of the first class, potash deposits and coal were frequently mentioned. As regards the second, we prefer not to enter upon a controversy as to whether Britain or Germany is the better equipped or better able to produce various classes (or any class) of manufactured products. Opinions about pianos and toys are sufficiently divided to be typical.

The policy of "keel for keel and ton for ton" has resulted in the dumping of two million tons of shipping suddenly upon the British market, and under the Treaty the Germans are liable for 200,000 tons of new shipping yearly for a number of years to come. This cannot fail to bring about a slump in shipbuilding, and to increase unemployment in that industry. Yet from the point of view of the owners and users of ships, it seems fair that their losses should be replaced, and that the home shipbuilding programme should consist of extensions to the pre-war tonnage.

Turning now to dyestuffs, we find that the Treaty provides for the immediate acquisition by the Reparations Commission of anything up to 50 per cent. of the total stock of all dyestuffs and chemicals held by Germany at the date of the Treaty's coming into force, and up to 25 per cent. of her total production for the next four years, or until the end of 1924. The dyestuffs industry, however, being one in which the Government is considerably interested, and, indeed, involved, has secured the passage of a Bill through Parliament which will safeguard the interests of that industry by a system of licensing, for the express purpose of restricting the importation of dyestuffs into this country; and not all the efforts of Lancashire and the other textile districts succeeded in obtaining any mitigation of the provisions of the measure. Yet, in spite of this, we know that the proposed production programme in respect of dyestuffs has been considerably curtailed, and that the installation of the plant required to put that programme into effect has been postponed. It would be interesting to be informed whether this curtailment is due to the influx of German dyes which we are to receive, or to an apprehension that the slump in trade of which everyone is talking is to be severe and prolonged.

We are faced with the *fact* that as Germany cannot pay in gold (and nobody wants paper marks), she must pay in goods, and that the importation of any kind of goods, raw or finished, for use, or even for re-export, renders unnecessary the production of a like amount of goods of that kind in the country into which those goods are imported. One gathers that the British Government is inclined to support this view, but that the French Government regards it with less favour. Nevertheless, an investigation of what is going on creates a strong impression that, in spite of the attitudes of the respective Governments, individual French firms are trading with Germany, but that, certain notable exceptions notwithstanding, individual British firms are not doing so.

For our own part, we do not believe that the slump in trade will be either as severe or as prolonged as seems to be commonly supposed. The present state of the international exchange acts as an effective bar to the export of British goods to many European countries. In France, with the franc at nearly 60 to the £, British prices frequently appear so fantastically high that, in spite of the congested state of the order-books of many French factories, it is not a commercial proposition for the Frenchman to buy from Great Britain. The same is largely true of Belgium, with the Belgian franc at 56 to the £, and Belgian customers have recently made considerable purchases of machinery at attractive prices and on good deliveries from Scandinavian manufacturers. In Holland, that favoured corner of Europe into which all the wealth appears to have been swept up, the gulden stands at 11, instead of the normal 12 to the £, but the slight reduction apparently brought about in the price counts for nothing with the mark at 260 to the £; and even the pro-British sympathies professed by the Dutch are not proof against German machinery prices at between one-third and one-half of the corresponding British prices. Holland is also in a position to buy from Belgium, and the Belgians are working very hard to restore their former status. The sentiment ignorantly expressed against America by some Englishmen, that she has done too well out of the war, can be heard in Belgium as well as in France with reference to England, but this feeling will disappear, at any rate in

* We should say 5 watts per candle, at normal voltage. But cheap carbon lamps might be over-run at a high efficiency with a short life.—Eds. Elec. Rev.

Belgium, as the franc rises in value. The import of iron and steel into this country from Belgium during the month of November, 1920, was four times what it was in the corresponding month of 1913. German coal is boosting French and particularly Belgian industry, while its scarcity delays the restoration of German industry.

The conclusion indicated by these facts appears to be that, until the restoration of something like normality in the European international financial situation, it is to British trade, at home and within the Empire, that British manufacturers, particularly of electrical goods, must look for their opportunities of output. At some future time we shall be able to fulfil the needs of Europe on as vast a scale as, or even vaster than, ever before; but now, if we have the courage, and go the right way about it, we are offered an unparalleled opportunity of building up such a trade connection within the world-wide British Empire as will defy all subsequent external efforts to undermine it.

NEW DISTRICT RAILWAY ROLLING STOCK.

There can be no doubt that everything that can possibly be done to cope with the tremendous problems presented by the congested state of the London traffic, is being done by the Underground Electric Railways Company.

A week or two ago we described a new type of car introduced on the Piccadilly Railway, and now we are able to give particulars of what may well be described as the *dernier cri* in electric railway rolling stock.

This, the first of an order consisting of 100 cars, was delivered last week, and on December 23rd representatives of the Press were given an opportunity of viewing the train and experiencing its running.

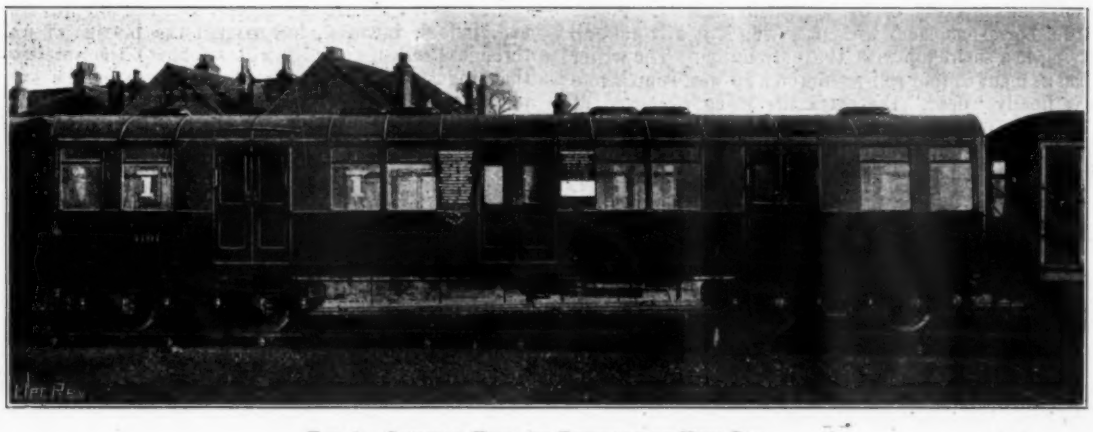


Fig. 1.—General View of Exterior of New Car.

Figs 2 & 3.—Interior of Car.

The car is slightly larger than the old type, being almost 50 ft. overall, while the extra width of the car—a foot—makes a wonderful amount of difference to the appearance of the interior and carrying capacity. Fig. 1 illustrates the exterior of the car. The most noticeable feature is undoubtedly the arrangement of the doors. As will be seen from fig. 1, there are three sets of sliding double doors on each side, each affording entry to two persons at a time. By this means a great deal of time will be saved at stations, leading to a general speeding-up of the service, and no matter in what part of the car a passenger may be seated, he will always have a door immediately accessible.

The diameter of the wheels is 6 in. more in this new type, making it 32 in. A new colour is used in the exterior finish; this is a dark red—known as "engine lake"—which greatly improves the appearance of the train.

The arrangement of the doors naturally divides the carriage into four parts. The seats in the end compartments are arranged transversely, and while designed to seat two persons, can seat three, owing to the absence of the usual arm-rest. In the two central divisions the seats are placed parallel to the length of the train. The seats are upholstered in a brown imitation leather, and in conformity with the present accepted practice have a backward tilt and convex backs. The much used (and abused) straps have been eliminated, and vertical rails are provided for standing passengers at the sides, and also in the centre.

Ventilation is effected by means of openings in the arched roof, the clerestory roof of the old cars having been dispensed with.

The lighting is excellent, being provided by lamps with opal reflectors. The roof is painted white, to give good reflection, while the lower part of the sides is brown, to harmonise with the upholstering of the seats. The floor is not of the usual wooden slab type, but is covered with linoleum, which will add to the cleanliness of the cars.

Everything has been done to make the cars bright and attractive, and all the fittings are very artistic, although simple. The metal parts are of Florentine bronze, and nickel plating has been applied to several portions of the work, including the hand-grip part of the vertical rail supports. Figs. 2 and 3 are views of the interior of the car.

The weight of each car is 26 tons, as compared with the 21 tons of the earlier type, and the cost of each is £7,500. As the cars are delivered it is proposed to put eight-car trains into service during the "rush" hours, these trains being made up of two self-contained components of five and three cars respectively, to make it easy to them divide during the slack periods.

The motor coaches, which had not commenced to arrive at the time of our visit, are of higher power than their predecessors, and will be capable of a speed of 45 miles per hour for "non-stop" runs. Improved braking arrangements will secure more rapid and even stopping.

The Metropolitan Amalgamated Carriage, Finance, and Wagon Co., Ltd., of Birmingham, is building the cars, and the electrical equipment is being manufactured by the British Thomson-Houston Co., Ltd., Rugby.

Victorian Industrial Expansion.—The development of the Morwell brown coalfields, in Gippsland (Victoria), and the establishment of extensive power houses there, in order to augment the present electricity supplies in the metropolis, are already bearing fruit. The establishment of a number of important industrial enterprises between Morwell and the metropolis is mooted. The Victorian Railways Department, with a view to meeting possible expansion along the Morwell line, is duplicating a portion of the main line at a cost of £250,000.—*Reuter's Trade Service* (Melbourne).

Children in Industry.—To-morrow (January 1st) the Employment of Women, Young Persons, and Children Act, which was recently passed, comes into operation. Thenceforth it will not be lawful to employ in an industrial occupation within the meaning of the Act any child under 14 who is not already so employed. The industrial undertakings covered by the Act include mining and quarrying, manufacturing and allied industries, the generation, transformation, and transmission of electricity, civil engineering work, including telegraphic, telephonic, and other electrical undertakings, and the transport of passengers or goods.

TELEPHONE CHARGES.

The Select Committee's Report.

The Select Committee, appointed in June, 1920, by the House of Commons to examine the present charges made to the public for the use of the telephone service and to report on their revision, has issued its report in the form of a White Paper (No. 247) dated December 20th. The Postmaster-General's Departmental Committee, appointed in 1919 "to consider what alterations in the existing telephone tariffs are expedient, with special reference to the necessity of placing the telephone service on a remunerative basis," issued its report (Cmd. 804) on June 30th last, which report formed the basis of the present inquiry. The Select Committee's report outlines the history of the telephone service from 1880; existing tariffs are then summarised, the finance of the system is considered, and finally its conclusions and recommendations are recorded.

The tariffs proposed in the above-mentioned Departmental Committee's report are considered to be justifiable and their adoption is recommended, but it is suggested that a rebate should be allowed to subscribers making 2,000 or more calls per year. The proposed tariffs are:—

For an exclusive exchange line in London, annual installation rental to be £8 10s.; in Birmingham, Glasgow, Liverpool, and Manchester, £8; and elsewhere, £7 10s., plus in each case a charge of 1½d. for each local call.

For trunk calls, in addition to local fees, each message of three minutes' duration between 7 a.m. and 7 p.m., 1½d. for a radius of from 5 to 7.5 miles, increasing by 1½d., 3d., and 6d., according to the increase in the radius.

It is estimated that if these tariffs are sanctioned and are in full operation by April 1st, 1921, the financial effect will be:—

Financial year.	Expenditure.	Revenue.	Balance.
	£	£	£
1921-22 ...	15,200,000 ...	16,000,000 ...	+800,000
1922-23 ...	16,700,000 ...	17,300,000 ...	+600,000
1923-24 ...	18,400,000 ...	18,600,000 ...	+200,000
1924-25 ...	20,200,000 ...	19,700,000 ...	−500,000

The recent fall in price of certain materials only represents a very small set off to the increase in wages, and the balance of £800,000 for the first year has been absorbed. Taken as a whole the service prior to the war showed a fair margin of profit, while the rates then existing would have been sufficient if conditions had remained unchanged and the system had developed on normal lines. Although efficiency was not strictly relevant to its terms of reference, the Committee considers that in many instances there is undoubted ground for complaint. Concerning the charge that Government ownership of itself produces fatal inertia, it is pointed out that owing to the war the Department has scarcely had a fair chance. Development depends on the small user, who should be canvassed, and additional revenue should be looked for from judicious development rather than from heavy increases in charges which may hamper development. An increase in the number of the little-known honorary Telephone Advisory Committees is suggested to whom subscribers should make their complaints and not to the Post Office; the committees would thus become a real link between the Department and the subscriber. Another recommendation is a considerable extension of the Research Department. "Inventive genius should be more liberally encouraged, both inside and outside the staff."

The discontinuance of both the flat rate and the measured-service rate is recommended. The message rate is the only equitable system of payment for service rendered. The change from the flat rate to the message rate is estimated to bring in an additional £1,200,000 per annum. It is hoped that the adoption of automatic exchanges will lead to fewer complaints with regard to charges for calls not used; such exchanges are already in operation in 13 towns in this country. The Post Office is conducting experiments with a view to devising an instrument which will check all subscribers' calls at their end, and the Committee considers it important that a subscriber's check should be introduced at the earliest possible date. Present charges for removals should not be increased.

The Committee concurs in the suggestion of the Post Office that the Postmaster-General should be able to refuse service to any subscriber on whose line the number of "engaged" calls exceeds 25 per cent. of the effective incoming calls, if he refuses to rent an additional circuit. The annual cost of handling such calls is stated to be £1,000,000. The surcharge of £4 on new installations should be abolished. Finally, the Committee recommends that should the accounts in any year show a substantial surplus a proportion of such surplus should be returned to subscribers by way of reduction in installation rentals; and that the question of charges should be reconsidered within the next five years by a Parliamentary Committee. Parliament has not approved of the above recommendations. Subscribers will receive a notice determining their present agreement for telephone facilities on March 31st next, and will be required to sign a new agreement.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Magneto Flash Lamp.

The usual dry battery or accumulator type of pocket lamp is subject to the necessity of renewal, which militates against its wider employment. A small and compact device has been produced by the General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4, which eliminates the battery by substituting a small magneto, completely enclosed in a handsome nickel-finished case, and operated through a train of strong gear wheels by a conveniently shaped lever pivoted to the case. As will be seen from the illustration (fig. 1), when not in use the handle is secured to the side of the case by a small retaining catch. A " bull's-eye " lens is fitted to give a concentrated beam, but this can be removed if a wider beam is required. The device has been named the " Handilite."

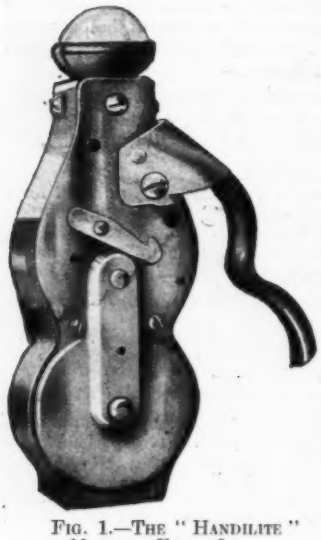


Fig. 1.—The " Handilite " Magneto Flash Lamp.

The " Sunglo " Electric Fire.

Among the latest types of electric fires brought out by Electric Fires, Ltd., King Street, Norwich, is the " Sunglo " (fig. 2). This is a most effective bowl fire of artistic design and high finish, which gives a reflected " beam " of heat. The copper bowl is swivelled, and can be locked in any position by tightening up knurled clamp nuts of ample size, enabling the fire to be employed for heating small quantities of liquid. The effect of the reflection of the spirally wound heating element in the polished copper bowl is very striking, giving a big red glow. The consumption of the fire is only ½ unit per hour (500-watt loading). The whole of the metal parts forming the heater are pressed, and mass production is thereby facilitated.

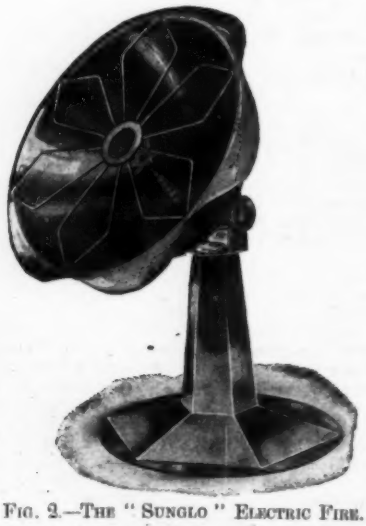
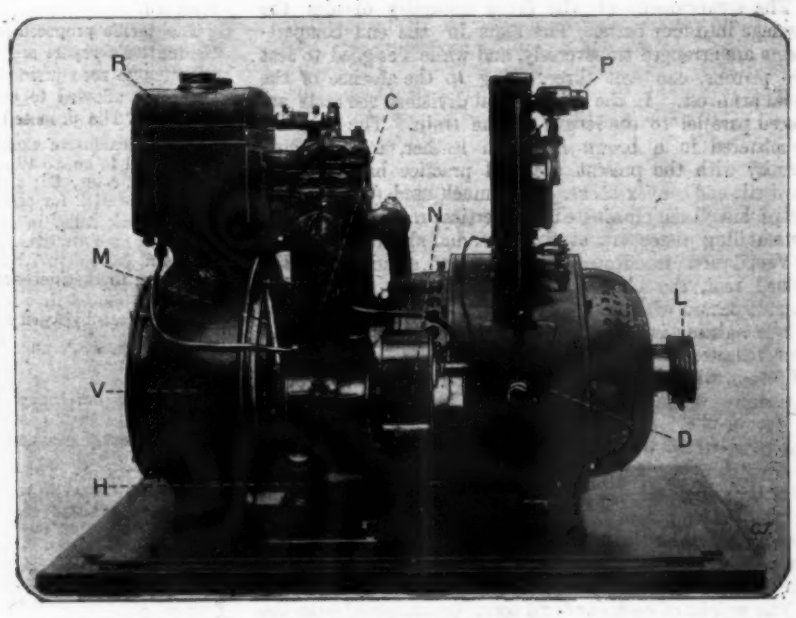


Fig. 2.—The " Sunglo " Electric Fire.

A 1-KW. Lighting Set.

The " Ballot " 1-kw. electric lighting set made by Hick-Diesel Oil Engines, Ltd., 70, Queen Street, E.C. 4, is a very compact plant measuring only 30 in. (length) by 18 in. (width) by 26 in. (height) overall. The set (fig. 3) consists of a single-cylinder, four-stroke vertical petrol engine driving a totally-enclosed 50-75-volt, D.C. dynamo through a flexible coupling. The engine ignition is by means of an H.T. magneto, driven by gearing. A highly sensitive governor assures smooth running and low fuel consumption. The cooling of the cylinder is effected in a new and ingenious way by means of the flywheel, which acts both as a water reservoir, water pump, and cooler. A circular trough is attached to the flywheel, and is fitted with radiator fins on its exterior. The centrifugal action causes the water in the trough to rise up a vertical pipe leading to the cylinder jacket. After passing through the jacket it runs back to the flywheel trough to be cooled. The switchboard, made of white marble, carries an ammeter, a voltmeter, a circuit breaker, and starting rheostat. A battery of 28/30 cells with a capacity of 75 ampere-hours, is supplied. The set is automatically started by a small switch, and this same switch is arranged to cut out the battery and to stop the engine when the former is fully charged, or, in the case of engine failure, to perform the first operation. The makers state that Messrs. Pathé Frères, the eminent kinematograph firm, have adopted this set as a standard in all their kinemas all over the world.



C, Carburetter; D, Dynamo; H, Lubricating Oil Tank; L, Pulley; M, Governor; N, Magneto; P, Switchboard; R, Water and Petrol Tank; V, Water Cooler.

Fig. 3.—The " Ballot " 1-kw. Lighting Set.

Correction.—With reference to the description of the turbo pump control switch appearing on p. 831 of our issue of December 24th, Messrs. Norrington & Landon, Ltd., the makers, wish us to state that in the phrase " if the water is there and the current valve is right," the word " valve " should read " value."

Overseas Trade.—Mr. Kellaway, Minister in Charge of the Overseas Trade Department, has appointed a Committee, consisting of officers of the Department, for the discussion of questions concerning the Department generally and of specific matters of importance. The Committee will meet fortnightly.—*Board of Trade Journal.*

THE HEATING OF BURIED CABLES.

(Abstract of Report discussed before the Institution of Electrical Engineers.)

The report is a preliminary one on the work already completed and of that contemplated in connection with the investigation which was undertaken to provide definite figures of current-carrying capacity for cables laid underground in the conditions prevailing in practice in this country. As a first step, a summary of all the hitherto published work was published in the *Journal* of the I.E.E., 1914, Vol. 52, p. 779. The investigation has been carried on under two Committees of the I.E.E., namely, the original Buried Cables Sub-Committee and the North-East Coast Sub-Committee on three-core cables, and in three places. The work of the two sub-committees has now been transferred to the British Electrical and Allied Industries Research Association.

Section I.

Report by Mr. S. W. Melsom and Miss V. Cockburn on Work at the National Physical Laboratory on Paper-Insulated Cables Laid Under Various Conditions.

The method used to determine the temperature rise was to use the cable core as a resistance thermometer, the change in total resistance as measured by a Kelvin double bridge giving the average temperature rise of the hottest part of the cable. A similar method was used to determine the temperature rise of the lead sheath. Some 47 samples of copper were tested for temperature coefficient, the resultant values varying from 0.00377 to 0.00407 for 1 deg. C., a maximum variation between any two samples of 8 per cent. For the purpose of the tests, the average figure for the whole of the samples of 0.00390 at 20° C. was used. In addition, some 230 samples of copper were tested for resistivity, the extreme values being 0.1513 ohm per metre-gramme (101.2 per cent. conductivity), and 0.1588 ohm per metre-gramme (96.5 per cent. conductivity). In these cases, however, the results for each cable were corrected for any variation of resistance. The value of temperature coefficient obtained by Dr. Marchant (see Section III) is 0.00409 at 10° C. (0.00393 at 20° C.).

For the determination of the temperature coefficient of the lead sheath, 21 samples taken from different cables were tested, the average temperature coefficient at 20° C. being 0.00385 for 1 deg. C. The highest value obtained was 0.00404, and the lowest 0.00373. The resistivity of the samples of lead was determined, the average value being 2.443 ohms per metre-gramme, equal to a relative mass conductivity of 6.2 per cent. The extreme difference between any two samples was 6.9 per cent., while in most cases the samples taken from the same cable agreed to within 1 per cent. From the point of view of consistency, both of resistivity and temperature coefficient, the lead sheath is nearly, if not quite, as consistent as the copper core; moreover, observations taken on the complete length as laid show that the resistance remains constant over long periods. In view of this, the method of determining the temperature of the lead sheath will be of considerable use in practice to ascertain the approximate temperature of a cable already laid, and especially where it is impracticable to use the cores.

In order to provide an accurate comparison of the cables under similar conditions and to investigate the effect of burying them in the ground under various conditions of laying, preliminary tests were made on all the cables in air.

A 0.1 sq. in. low-pressure single cable attains to its maximum temperature in from 2 to 3 hours, while a 0.15 sq. in., three-core, H.P. cable requires about 8 hours, fig. 1; these values will depend both on the size of the conductors and on the thickness of the dielectric. Heating curves illustrate the overall differences that may be obtained with cables of nominally the same type and size, the differences being due to a number of factors. Tests were made both with A.C. at 50 cycles per second and with D.C., and there was no appreciable difference between the two sets of results.

The extent of the difference in the heating due to the presence of armouring on a 10,000-volt three-core wire-armoured cable in air is very small. The above remarks refer to armouring only, and not to the difference between a bright lead finish and the dull black of an armoured cable.

It would appear that the actual colour of the surface makes little difference, but that a bright surface produces a marked change. While there is an appreciable difference between the heating with bright lead and dull black covering respectively, there is no marked difference between white and black.

Turning to the tests on buried cables, a complete investigation was made of the thermal conditions along the duct. The results show that little reliance can be placed on any measurements made by means of a thermometer pushed into a duct; thermo-junctions proved unsatisfactory, so a cable with a number of potential leads fixed along its length was used. Ideal tests in air showed that the rise of temperature of the various sections of the cable was quite uniform. When, however, the cable was drawn into the duct the temperature along the length of the duct was not quite uniform, but rose slightly at each end, which was not due to heating at the ends.

The temperature conditions from one hole to another of the duct apparently did not vary appreciably. The heating curves of a 0.1 sq. in. cable in an upper and in a lower hole in the duct are very nearly alike. The end effect in armoured cables and in those laid solid in bitumen is a serious factor in connection with the rating of cables under actual working conditions where the end of the cable is brought into a junction box or to the back of a switchboard. The extent of the difference may be judged from Table I, showing results obtained with a 0.2 sq. in. concentric armoured cable laid direct in the ground. The difficulty could be met in practice by joining the cable in the ground with a tail of larger section.

TABLE I.

Current	350 amp.	450 amp.
Cable temp.-rise in ground	33° C.	59° C.
Temp.-rise of last 10 ft. (5 ft. in soil, 5 ft. in hut)	45° C.	84° C.

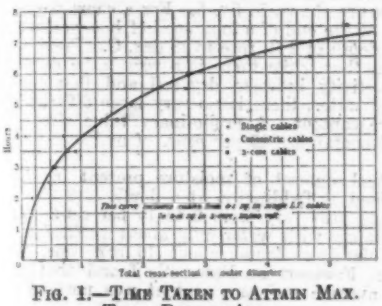


Fig. 1.—Time Taken to Attain Max. Temp. Rise in Air.

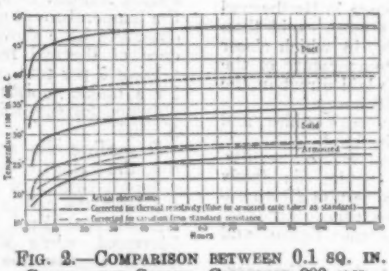


Fig. 2.—Comparison between 0.1 sq. in. Concentric Cables, Carrying 200 amp., laid in Different Ways.

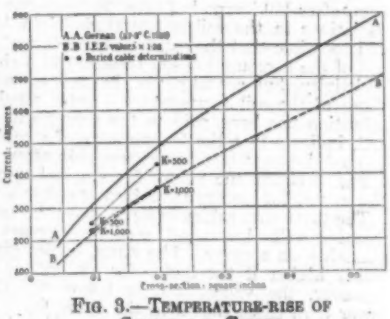


Fig. 3.—Temperature-rise of Single L.T. Cables.

The effect of natural ventilation on the heating of the cables in the duct was also investigated. For this purpose cables were run with the duct holes closed up, as well as under the normal conditions when they would be open. No difference could be detected in the temperature rise obtained in the two cases.

TABLE II.

I_1 = Current required to produce a given temp. rise when tested in air.

I_2 = Current required to produce the same temp. rise when buried.

Cable.	Method of laying.	I_2.	I_1.	I_2/I_1.
0·1 Single	Solid in bitumen	266	216	1·25
0·2 Single	Solid in bitumen	432	350	1·23
0·1 Concentric	Solid in bitumen	199	165	1·22
0·2 Concentric	Solid in bitumen	360	293	1·23
0·1 Concentric	Armoured, direct in ground	215	176	1·22
0·2 Concentric	Armoured, direct in ground	335	275	1·21
0·1 Concentric	Drawn into stoneware ducts	130	133	0·98
0·2 Concentric	Drawn into stoneware ducts	243	252	0·96
0·5 Concentric	Drawn into stoneware ducts	370	378	0·97
0·1 3-Core L.T.	Drawn into stoneware ducts	157	162	0·97
0·1 3-Core H.T.	Drawn into stoneware ducts	162	170	0·95

The effect of the different conditions of laying is best shown by a comparison of the results obtained with the same cables when laid in air, Table II, for different sizes of cables. The values of I_2/I_1 are remarkably constant for different sizes of cables, but nearly all of them apply to low-pressure cables. It is probable that in the case of cables drawn into ducts, the value of the factor for H.P. cables would be nearly the same as

that for L.P. cables, but it is reasonable to assume that, comparing the heating of a L.P. and a H.P. cable when laid in air and buried direct in the ground, while the L.P. cable would be hotter than the H.P. cable when tested in air, the factor I_2/I_1 for the H.P. cable would be lower than that obtained for the L.P. cable. This assumption is confirmed by some results obtained with a three-core 0.2 sq. in. split-conductor 20,000-volt cable, buried direct in the ground. The value of I_2/I_1 obtained, however, is more nearly unity as compared with 1.21, the figure found for a L.P. cable buried direct in the ground. Further tests are being made with H.P. cables laid direct in the ground, and until these are available the factors given for cables laid direct in the ground should not be used for H.P. cables.

A typical heating curve for concentric cables laid under different conditions is shown in fig. 3, which refers to 0.1 sq. in. cables. The actual results are given, together with those corrected to a common basis of thermal resistivity and nominal conductor resistance. When thus corrected, the final temperature elevation of the armoured and solid laid cables is nearly identical. The time required to attain to that temperature is, however, different for the three cases. Assuming that after 100 hours the cable has attained to its maximum temperature, Table III shows the comparative rates at which the temperature of cables rises when laid under the three systems.

TABLE III.

Period.	Per cent. of maximum increase.		
	Duct.	Solid in bitumen.	Armoured direct in ground.
After 7½ hours ...	95	88	85·5
After 20 hours ...	98	92·5	91·4
After 40 hours ...	99·0	95·5	93·1
After 60 hours ...	99·8	97·0	95·8
After 80 hours ...	99·8	98·8	97·9
After 100 hours ...	100·0	100·0	100·0

The cables in the duct reach their maximum temperature sooner than either those laid solid or direct in the ground, although all of the cables reached to, or above, 90 per cent. of their maximum heating in 20 hours. Fig. 2 shows that the temperature of the armoured cable is apparently still rising, even after 110 hours, but after 60 hours the rise is so slight that variations in the soil temperature begin to affect the results. It is possible that the continued rise is really due to the drying out of the surrounding soil resulting in a change in its thermal resistivity, but actually the changes are not more rapid than those of the soil temperature. Later results, in which closer attention has been paid to the changes in temperature of the soil, indicate that the temperature of a cable laid direct in the ground does not increase appreciably after 50 hours.

Fig. 3 shows the values for single low-pressure cables, and the values for concentric cables are shown in fig. 4.

The three-core cables in fig. 5 show the most variable results. Results with low- and medium-pressure cables lie fairly smoothly on a curve. The E.H.P. cables give results all appreciably higher if the factor for L.P. cables be used. Actually, however, the values will be below the German figures and lower than those shown in the curve C_1.

Figs. 3 to 5 should only be considered to be preliminary, until the final results with the largest sized cables buried in the ground are available, and tests for dielectric losses are completed.

The results obtained with the cables already laid, and particularly those with the jute-insulated cable, suggested that the thermal resistivity of the insulating material might vary with different cables to a larger extent than had hitherto been supposed. This is also shown by the values obtained experimentally on a three-core cable tested in air, which show that the heating is very little greater than for a concentric cable, although 50 per cent. more watts are being put into it. The differences were due to the value of the thermal resistivity not being the same for both cables.

An examination of the values of thermal resistivity obtained shows that the higher values were more often obtained with the L.T. cables. In the case of the six cables representing more modern E.H.T. three-core cable, the values were all low, the average being about 500. Thus, for this type of cable it appears probable that a value of 500 or so might be taken as the normal figure, as compared with the accepted German value of from 550 to 650. The current-carrying capacity of the cable is not affected by the thermal constants to the extent that at first sight might be expected. The thermal resistivity does not appear to be affected by temperature, within the limits of temperature attained in the cables.

With regard to characteristics of the soil, results obtained in midsummer and midwinter have been compared, but there is no evidence of any difference. It is to be expected that seasonal changes, involving as they do a difference of initial temperature of about 10 deg. C., would have produced a change in the temperature rise, but it would seem that any such change is masked by possible variations due to rainfall, &c. Daily observations of the temperature of the ground at points near the cables are shown in fig. 6. For a short period during August, 1919, at the end of a long spell of hot weather, the temperature at a depth of 2 ft. rose to 18 deg. C. Previous observers have shown that while there is a very large difference of thermal resistivity between dry soil and that containing 5 per cent. of water, there is no very large difference for a higher moisture content. A preliminary value already obtained for fine soil containing 15 per cent. of moisture was K=106.

Regarding the actual amount of moisture present in the soil, the values obtained at Teddington at a depth of 2 ft. at different periods of the year vary from 9 to 15 per cent. In this case the soil is sandy with water only about 12 ft. from the surface. Prof. Marchant found about 10 per cent. in Liverpool, while Mr. Fawssett in Newcastle found that in winter weather the average moisture content was never far from 20 per cent.

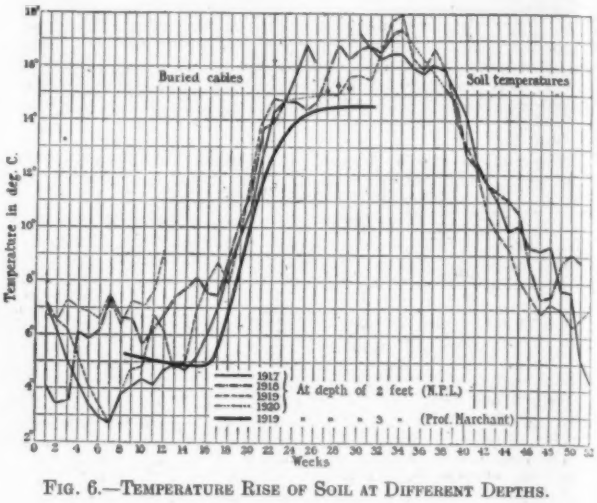


Fig. 6.—Temperature Rise of Soil at Different Depths.

(To be concluded.)

Discussion at Manchester

At Manchester the report was discussed before the North-Western Centre of the Institution on December 7th. Mr. Jul'us Frith occupied the chair.

Mr. Ratcliffe said that the report had been eagerly awaited for several years, and for that reason he was afraid it would be found rather disappointing; at the same time it was very reassuring. As far as he could judge from the numerous curves and figures given all the cables with which he had any acquaintance at the moment were supremely safe. The report was simply packed with information, so much so that it was very difficult to pick out for critical analysis exactly what they wanted, and he feared that it did not tell them exactly what they want to know. The statement of the work outstanding showed that although much had been done it was a comparatively small portion in comparison with what remained to be done. That being so, he suggested a rather different method of procedure, namely, to commence at the end and work backwards. "First obtain samples of the various types of cables and test them to destruction; find out what they will stand," then it might be possible to indicate the conditions under which the danger limits were likely to be attained in practice. In some cases it might be found that there were other limitations, and that in practice the danger

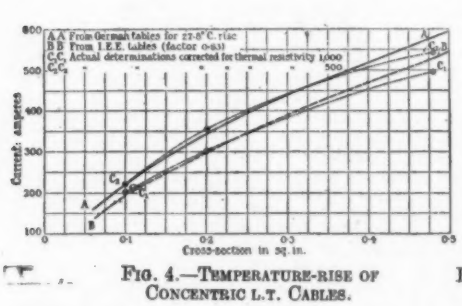


Fig. 4.—Temperature-rise of Concentric L.T. Cables.

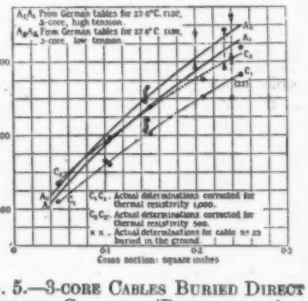


Fig. 5.—3-core Cables Buried Direct in the Ground. (Preliminary.)

limits would never be attained. For example, in the case of L.T. cables economic considerations might come in long before the cable attained a dangerous temperature, the copper losses might become excessive. In the case of medium-pressure cables mechanical considerations would come in long before they reach the danger point, *i.e.*, expansion and contraction troubles in a very intense degree. In that case they need not worry very much about the temperature of those cables. The most important work at the moment was that on the E.H.T. cables; they should make a start with those for two reasons. One was the principle that the greater included the lesser; the other was because they were the cables that they knew least about. The information given in Mr. Fawssett's report was very valuable, because in order to obtain room for cables they frequently had to drive headings at 10, 12, even 15 ft. depth; the streets were becoming so congested that there would be practically no room for cables in the future. They might have to go down somewhere to the level of the sewers. They were possessors of 33,000-volt cables. When they started on their specification some three years ago they found that there was not much information available, and there was the fearful bogey of dielectric losses. In fact the dielectric losses seemed to be the limiting factor with E.H.T. cables. After consultation with the principal cable makers and reference to all available sources of information, they arrived at a figure of 60 deg. C., for the maximum temperature of the conductor; that was a very safe figure, and they had a margin. The next thing was how were they going to share that total temperature. It was a very big thing to say exactly what the ground conditions were going to be throughout a 10-mile run. They assumed outside values—the most dangerous conditions which they could think of. They, therefore, took the maximum temperature figure at 60 deg. C. and roughly divided that between the inside and the outside of the cable, and gave the cable makers a 25 deg. C. temperature gradient to do what they liked with; they had not, in fact, quite touched it. From tests they judged that that had been a safe distribution of the temperature, and it only remained to be seen whether those temperatures seriously affect the dielectric losses. In order to obtain conditions which would be on a par with anything attained in practice they specified that the cable should be coiled on a drum, not a working drum, but a skeleton iron drum, and that copper had to be coiled on the drum in not more than two layers, preferably one layer. That gave very serious conditions indeed, because they had the two coils of the cable round each other, and the only cooling medium was air, which was about the worst cooling medium. Then, in order to have a factor of safety, they put two times the working pressure on the cable so that they had the full current and superimposed a pressure of 7,000 volts, which gave about double the normal dielectric loss. Under those conditions the cable was heated for ten hours, because as a rule after about nine hours the temperature conditions became fairly steady. That gave a figure for the approximate temperature rise. They corrected to some extent the seasonal variation by adopting a base temperature of 20 deg., and checking everything to that value by increasing or reducing the load according to whether the ambient temperature was greater or less than 20 deg. C. After that heat run with the dielectric loss and the copper loss, the cable was allowed to cool down and was then heated up again with the copper loss only, and it was assumed that that gave a measure of the dielectric loss expressed as a percentage of the copper loss. In one manufacturer's works where those tests were carried out they measured the dielectric losses, which were found to be in extraordinarily close agreement with the results arrived at thermally.

Mr. C. J. BEAVER was also somewhat disappointed when he found that the reports were somewhat in the nature of progress reports without definite conclusions. Although he would not like it to go forth to the world that cable makers were entirely held up awaiting that information, he realised that it was the kind of work that would be of a rather *ex-parte* character if it were carried out by cable makers themselves. At the same time it would have been advantageous if the cable makers had been more strongly represented on the committee, from the point of view that it must be to the general disadvantage not to be abreast of all the progress which was made inside the cable works. There were differences in the progress made at different cable works. The ultimate object of the present research was presumably the rating of all types and all sorts of conditions of laying and, perhaps, of installations generally. He thought it should go even further than that, because it had been carried out on a thoroughly scientific basis. With various investigators who had been engaged on work of that kind the tendency had been to do a certain amount of experimental work, and then endeavour to convert their results into physical constants which would enable them to apply them to all sorts of cables and all sorts of conditions of laying, and the result had been not at all successful. When the work of the committee was completed it should afford so strong a basis of experimental evidence that it should be possible to construct formulæ which, although they might be empirical, would be on such a sound basis that it would be possible to insert factors and values relating to the dimensions and physical constants, which would enable anybody to arrive at a temperature rise of any kind. One probable result whch he foresaw was that it would become more and more the regular thing for thermal tests, or tests bearing upon the thermal properties, to be embodied in the routine testing of a cable factory, and rightly so. The work which was outstanding was of much greater magnitude than the work which had been already done. With regard to the statement that it was "essential that the Association should settle upon (*a*) the permissible temperature rise," the thing that mattered was not the temperature rise, but the maximum final temperature employed. Instead of thermal resistivity, he personally preferred to speak of conductivity. No reference was made anywhere to rubber insulators; from the heat dissipation point of view, vulcanised rubber was a very favourable material. Its resistivity varied from about 515, or thereabouts, down to something in the neighbourhood of 325. As regarded variations between the different lengths of cable operated upon, there was a fair amount of difference between the materials used, and the manufacture would vary to some extent. The manufacture and assembly of the component parts had a very powerful effect especially with material of a laminated character. The American practice referred to in the report was quite different to anything in this country. Their allowance for heating and dielectric loss on a 30,000-volt cable was excessive in comparison with the ordinary English practice. "The amount of moisture in the soil is to be determined in three towns over long periods" was not the best way to get the information desired. The thermal conductivity of the soil varied tremendously not only as between different types of soil, but also according to the moisture. "River sand" with 10 per cent. of moisture decreased the resistivity by about a fourth; the only real method to obtain information on that subject was to test a wide variety of soils, and then it should be remembered that cables were laid through probably a dozen types of soil.

Mr. B. WELBOURNE, who has been associated with the committee for the last two and a half years, explained that the work had been carried out under the most difficult conditions, partly under wartime conditions, and partly under post-war conditions, which were perhaps worse, and there had been difficulties in getting samples of cables with which to carry out the work. It was possibly due to his pertinacity, backed up by the president, Mr. Atkinson, that those discussions were taking place, with the view, as Mr. Wedmore told them, of asking for constructive criticism, and particularly in order that they might get the views of cable users and manufacturers on the further points that required investigation in the country. It was a very preliminary report; possibly the final report would not be forthcoming for another two or three years. There were quite a number of users of cables who did not appreciate the fact that the armoured cable represented the best value for the money. The results obtained with the specimens of 17-22 were extremely uniform, and placed them in a class quite apart from the results which had been obtained in America and in Germany. With regard to the indiscriminate use of the words "pressure" and "tension," the former was the only possible one to use, and he hoped the word "tension" would be abandoned.

Mr. H. ALLCOCK drew attention to the value of the report to the Institution, it being the first fruits of the Research Association. Considering the various methods of dissipating the heat generated, the American journals had contained references to the circulation of air and even water for the purpose of dissipating that heat; perhaps the committee could give that idea some attention.

The CHAIRMAN (Mr. J. Frith), with regard to the tests of dielectric losses, said he would have tried to get the same temperature rise by varying the current without the dielectric loss rather than have the same current and measure the different temperature rises. That seemed to him a more direct way of doing it than the neat use of D.C. and A.C. superimposed for measuring resistance.

Mr. S. W. MELSOM, in reply, did not agree that the cables should be tested to destruction. What they were really endeavouring to ascertain was the temperature which the cable would stand for an indefinite period without deterioration. The final experiment would involve at least a couple of years. The method which Mr. Ratcliffe had used had been discussed in committee, and the N.P.L. intended to make use of it. Mr. Beaver's figures of the thermal resistivity with regard to moisture in the soil agreed very closely with their own; Dr. Kennelly gave the figure of 500, if one got something like 10 per cent. of moisture the difference in the different types of soil disappeared; 10 per cent. moisture meant 120, and 15 per cent. moisture meant 180. There was such a huge difference due to the moisture that it did appear that different types of soil must fall together at the same time. In view of what Mr. Beaver had said about the thermal resistivity of bitumen they would check their figure thoroughly; he hoped that Mr. Beaver's correction—300 instead of 500—was correct, because it would explain results which at present they could not explain. The problem of the thermal characteristics of tiles, &c., was a matter of the nature of the surface, whether it was wet or otherwise, rather than of the actual colour. Mr. Beaver's suggestion that different types of paper might give different results would have to be checked experimentally. The obstacles before them in carrying out that work have been overcome.

Mr. E. FAWSSETT, referring to cables at 10 or 12 ft. in depth, remarked that they had a few results of temperature rise at that depth, but there seemed to be very little increase over

the 4 ft. With regard to moisture, tests had been made of almost every conceivable kind of soil met with by cable engineers in laying cables all over the North-East Coast, ranging from fairly dry sand to wet chemical refuse, clays of all sorts, gravel, ordinary garden soil, everything they could think of, at every time of the year, and under every condition of rainfall, after a very dry time following a spell of north-east winds, and after several days' heavy rain, and at depths varying from 2 in. to nearly 4 ft. The figures varied from 8 to 40 per cent. on the North-East Coast; the average on the whole set of samples was something like 20 per cent. Mr. Black at Glasgow had made another series of tests, and, rather contrary to expectations, his figures averaged slightly higher than the Newcastle figures.

Prof. E. W. Marchant, referring to the statement that there had been no attempt to obtain any relation between temperature rise between the core and the sheath, and between the sheath and the earth, said they had made some attempt to do that, and they had got a figure for the resistivity of the cable which was somewhere near the figure assumed by Mr. Ratcliffe, who agreed. With a given material the loss of heat on the cable depended upon the ratio of one diameter to the other, and not upon the thickness.

Mr. E. B. Wedmore welcomed heartily the suggestion from Mr. Beaver that they should obtain further co-operation from the cable makers, who had already supported them most liberally in various ways, and expressed appreciation of the support they had received from the Department of Scientific and Industrial Research.

LEGAL.

Charges Against German Electrical Manufacturer.

At Bow Street Police Court, on December 23rd, before Mr. Chester Jones, Samuel Michael Stroock, or Struck, manufacturer of electrical goods, again appeared on a provisional extradition warrant charging him with obtaining money and goods by false pretences within the jurisdiction of the German Government. At previous hearings counsel for the defence had protested that the arrest of the defendant was irregular, on the ground that he was a citizen of the United States, which country was still technically at war with Germany. Further charges were now preferred against him of having, while an alien enemy, come into this country without the permission of the Home Secretary, and of having made false statements to the immigration officer at Dover and the aliens registration officer in London. Mr. Muskett, who represented the police, said that it had now been ascertained that the defendant was a German, born in Berlin. The American passport found upon him must have been obtained by false representation. He understood that the defendant was prepared to plead "Guilty" to one of the new charges, and if that were so, the police would merely ask for a recommendation for his deportation. The magistrate remarked that the period allowed by the Treaty for the production of the whole of the depositions in the extradition case would expire next week. With regard to the new charges, he would be prepared at the next hearing to recommend the defendant for deportation.—*The Times.*

THE ELECTRICITY (SUPPLY) (No. 2) BILL.

The Bill* which is to come before Parliament early in the new session was briefly summarised in our last issue. The following are the principal provisions:—

1. A joint electricity authority may with the consent of the Electricity Commissioners borrow money in accordance with regulations to be made by the Ministry of Transport, for the purchase of generating stations and main transmission lines or of undertakings or parts of undertakings under the Act of 1919, for any other purpose authorised by that Act, and for use as working capital; such money, and the interest thereon, to be charged on the undertaking and the revenues of the authority.

2. Sinking fund payments in respect of new works may be suspended for not more than five years from the expenditure on such works.

3. The Commissioners may authorise an authority to issue stock for the above-named purposes.

4. Authorised undertakers, consumers, and local authorities concerned may lend money, subscribe for securities, and otherwise give financial assistance to the authority; any company or association may do likewise, notwithstanding any regulation under which it is constituted.

5. Provision is made for the apportionment of the expenses of the Electricity Commissioners amongst the joint electricity authorities and undertakers, in accordance with their output of energy.

6. Payment to a local authority may be made by any method approved by the Commissioners.

7. An authority may use any main transmission line by agreement with the owners.

8. The Commissioners shall have power to order the transfer of an undertaking in whole or part to the authority, or to empower the authority to supply electricity, in any area where the authorised undertakers are unable or unwilling to give reasonable facilities for the supply of electricity, including the provision of new works.

9. An authority may dispose of works, land, &c., no longer required.

10. Wayleaves that have been in force may be maintained in operation after the termination of the agreements.

11. An authority may agree with the former owner of a transferred station or line that such owner shall work and maintain the same on behalf of the authority.

12. An authority may perform its duties if authorised by a special order, through any authorised undertakers.

13. The prices charged for electricity must cover revenue expenditure over a period of years with a margin fixed by the Commissioners, who may impose modifications necessary to secure the benefit of a reduction in cost due to the Act of 1919 or the present Act to consumers.

14. Maximum prices may be revised after three years.

15. Section 18 of the Act of 1919 is amended.

16. Owners of power stations for traction may supply electricity to a joint authority, authorised undertaker, or consumer, with the consent of the Commissioners, who may authorise the breaking up of roads for that purpose.

17. Provision is made for the payment-off of debentures on a transferred generating station.

18. Provision is made for winding up statutory companies whose undertakings have been transferred to a joint authority.

19. The period of repayment of capital borrowed in future by Scottish local authorities is extended from 30 to 60 years.

20 and 21. The Act is to apply to Scotland and Ireland.

* Bill 263. From H.M. Stationery Office, price 2d.

BUSINESS NOTES.

Company Liquidations.—Cannon Motor and Electrical Works, Ltd., Cannon Lane, Upper Russell Street, Brighton.—A meeting of the creditors of the above was held recently at Brighton. The statement of affairs presented by the liquidator showed the position as at December 3rd last, and it disclosed total liabilities of £3,930, of which £3,878 was due to unsecured creditors, the balance of £52 being in respect of an overdraft at the bank. The assets were estimated to realise £1,919, from which had to be deducted £96 for preferential claims, leaving net assets of £1,823. The assets consisted of stock-in-trade, £1,039; plant and utensils, £212; furniture, &c., £50; good book-debts, £578; doubtful and bad debts estimated to produce £25; and cash in hand, £15. With regard to the unsecured liabilities, it was stated that rather more than £3,000 was owing to a cash creditor for money lent. The company was formed in May, 1919, with a capital of £1,000 divided into ordinary shares of the face value of £1 each. It was stated that an offer would be made of a composition of 8s. in the £, and the creditors unanimously decided that the offer should be accepted.

Masham and District Electric Supply Co., Ltd.—Meeting of members is called for January 19th at the Town Hall, Masham, to hear an account of the winding-up from the liquidator, Mr. T. E. Thwaites.

Woods Gilbert (British) Rail Grinding and Milling Co., Ltd.—A meeting of members is called for January 24th at the Woods Gilbert Rail Remodelling Co., Ltd., offices, 170, Strand, W.C., to hear an account of the winding up from the liquidator, Mr. A. G. Conway.

Newalls Insulation Co., Ltd.—Meeting of members is called for January 28th at 18, Market Street, Newcastle-on-Tyne, to hear an account of the winding up from the liquidator, Mr. F. S. Newall.

Dissolutions of Partnership.—Caig Brothers & Jones, electrical engineers, 61, Renshaw Street, Liverpool.—Messrs. H. Jones, A. Caig, F. S. Green, and J. D. Caig have dissolved partnership. Debts will be attended to by Messrs. A. Caig, F. S. Green, and J. D. Caig, who will continue the business under the same style.

S. & C. Electric, electrical engineers, 25, Beckenham Road, Penge.—Messrs. C. T. Stanton and C. M. Cooking have dissolved partnership. Debts will be attended to by Mr. C. T. Stanton, who will continue business as an electrical engineer at 25, Beckenham Road, Penge, under the style of the Southern Electric and Engineering Co. Mr. C. M. Cooking will carry on business on his own account as an electrical engineer at 46, Oakfield Road, Penge.

S. E. Blakeney, general and electrical engineers, 86, Sheen Lane, Mortlake.—Messrs. S. E. Blakeney and F. Musson have dissolved partnership. Mr. S. E. Blakeney will attend to debts and continue the business.

Bankruptcy Proceedings.—J. Jagger (J. Jagger & Co.), electrical engineer and contractor, 28, Northgate, Halifax.—First and final dividend of 4s. 6d. in the £, payable Jan. 10th, 1921, at 9, Fountain Street, Halifax.

J. W. Layton, electrician, 5, Nobles Bank, Sunderland.—The public examination of this debtor took place at the Sunderland Bankruptcy Court, on December 23rd. The hearing was adjourned until January 20th, the debtor to furnish an account within 14 days showing the particular losses he incurred due to the rise in the price of platinum.

Receiverships.—Steel Wing Co., Ltd. (formerly Krieger Electric Carriage Syndicate, Ltd.)—Mr. H. W. D., Saper, of 7, Great Winchester Street, E.C., was appointed receiver and manager on December 7th, 1920, under powers contained in the mortgage dated July 29th, 1920.

Catalogues and Lists.—The Photector Co., Ltd., Central Hall, Southall.—An illustrated list of domestic appliances of French manufacture, including saucepans, irons, boilers, heating pads, foot and bed warmers, small transformers and fires, together with a price list of these articles.

The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, W.C. 2.—An illustrated and fully priced catalogue (16 pp.) of domestic electrical appliances, including irons, kettles, cookers, vacuum cleaners, &c.

Messrs. Alfred Herbert, Ltd., Coventry.—Illustrated leaflet (Section F 1, fourth edition), dealing with a sand mixing machine suitable for use in the foundry.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Folder No. 2,421, "The Problem of the Christmas Gift." This gives illustrations and prices of a number of useful electrical appliances. Also Publication No. O 2,378 (8 pp.)—an illustrated price list of motor-car and motor-cycle electric lamps of the "Osram" and "Geeko" patterns.

The Stanton Ironworks Co., Ltd., Stanton-by-Dale, nr. Nottingham.—A list giving details of straight spigot and socket pipes, straight flange pipes, &c., in stock. The front of the list bears a calendar for January, 1921.

Trade Announcements.—Messrs. W. H. Pease & Co., engineers and merchants, of Kingsgate Mansions, Red Lion Square, W.C., have removed to 8, Southampton Row, W.C. 1.

Engineering Supplies, Ltd., of Suffolk House, 5, Lawrence Pountney Hill, have removed to Mansion House Chambers, 11, Queen Victoria Street, E.C.

Mr. H. W. Sullivan, electrical and telegraph engineer, 368 and 369, Winchester House, London, E.C. 2, has appointed the following firms agents for his wireless apparatus: for Newcastle and district, Messrs. G. S. Douthwaite & Co., 25, Dean Street, Newcastle-on-Tyne; for Wales, Mr. A. E. Hay, 6, Oxford Street, Mountain Ash.

The Imperial Electrical Works, 7-12, Imperial Mews, St. Martin's Avenue, East Ham, asks us to state that its telephone number is East Ham 801, not 101 as recently given.

Messrs. Alfred Herbert, Ltd., Coventry, have been appointed sole distributors for Great Britain and Ireland, for the sale of the fine precision measuring instruments manufactured by the Soc. Anon. des Etablissements P. Roch, Rolle, Switzerland.

Mr. J. S. James, for 36 years with Messrs. Edwards & Armstrong, has commenced business as an electrical contractor at 4, Hill Street, Trowbridge.

Mr. C. Leash has commenced business as an electrician at 126, Adelaide Grove, East Cowes, Isle of Wight.

Calendars, &c.—The Key Engineering Co., Ltd., have sent us one of their celluloid pocket calendars for 1920.

Messrs. Pirelli, Ltd., have again issued one of their useful wall calendars for the New Year. A block of date and engagement slips, printed boldly in red, is mounted on a strong metal base. The design appearing above shows a large Pirelli tire with the wording: "Pirelli tires are the world's best."

Messrs. Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E., have issued a strongly-bound blotter (17 in. × 11 in.), each sheet of which bears a calendar for 1921; also a large hanging calendar with a sheet for every month.

The County of London Electric Supply Co., Ltd., have issued a card for recording telephone numbers, bearing a clever black-and-white drawing showing a man and woman enjoying the warmth of an electric fire upon a late return home.

We have received a useful desk memo. calendar, with daily slips on a metal base, issued by the Chloride Electrical Storage Co., Ltd., of Clifton Junction, Manchester.

The Star Electrical Engineering and Manufacturing Co., Ltd., of 134, Victoria Street, Grimsby, have issued two pretty wall calendars. The subject of one is a lady in night attire holding a lighted candle with the wording: "Good Night," at foot; the date slips are hidden beneath a buff card. The other calendar has monthly slips for the year below a coloured reproduction of two pretty children writing a letter, with the words: "To Daddy," underneath.

Messrs. Mather Bros. have sent us a wall calendar for 1921, with monthly slips printed in red; also a useful telephone address card.

From the Davenport Engineering Co., Ltd., of Bradford, we have received a wall calendar, with a block of daily slips for 1921.

The Saxonia Electrical Wire Co., Ltd., of Roan Works, Greenwich, has produced a small wall calendar with monthly slips printed in white on a chocolate ground.

Messrs. Haslam & Stretton, Ltd., of Cardiff, have sent us a handsome wall calendar. "Peggy" is a charming and captivating study, and her presence will add brightness to any office or private apartments. The date slips are quite unobtrusive.

Messrs. W. H. Sugden & Co., of Wakering Road, Barking, have issued a wall calendar with neat and small monthly date slips below, a view of the Gate of London showing the Tower Bridge.

The Pirelli-General Cable Works, of 144, Queen Victoria Street, E.C., have issued a handsome calendar with monthly date slips, with a useful note-pad at the foot, also a loose-leaf note-book with celluloid cover showing a view of the Southampton works.

From the General Electric Co., Ltd., of 67, Queen Victoria Street, we have received a wall calendar, with monthly date slips below a coloured reproduction of one of their show cards of a hand holding one of their Osram G.E.C. lamps with the wording: "The lamp of established reputation."

A Trade Union Combine.—A conference of representatives of four Unions, on December 21st, discussed a scheme for amalgamation which when completed will, it is claimed, create the largest single Trade Union organisation in the world, with an immediate total membership of over 1,000,000. This is only exceeded by federations of unions. Mr. Will Thorne, M.P., presided at the conference, and among those present were Mr. J. R. Clynes, M.P. (president of the National Union of General Workers), and Mr. Arthur Hayday, M.P. The Unions affected by the amalgamation are: Natiopal Union of General Workers, Workers' Union, Municipal Employés' Association, and National Amalgamated Union of Labour. The conference completed a draft of proposals for amalgamation of the four Unions. This will be submitted to the executive of each of the Unions concerned so that any amendments they desire may be put forward. A joint meeting of the four executives will be called early in the New Year to consider any amendments that may be proposed to the scheme. It is expected that at this meeting a formal agreement will be arrived at, and that immediately afterwards a ballot vote of the members of each Union will be taken on the acceptance or otherwise of the amalgamation scheme.—*Daily Telegraph.*

Wages in the Electricity Supply Industry.—A statement issued by the Trade Union side of the East Coast Area District Council (No. 8) says that the employers had on two occasions moved resolutions (not specified) to which the Trade Union representatives were unable to agree. The employers had kept the matter in the balance so long that the patience of the employés had been tried to breaking point, and meetings had been held in various centres, including Norwich, Ipswich, Yarmouth and Lowestoft, at which it was urged that strikes be called to enforce the men's claims.

Private Meeting.—The Electrical Maintenance Co., Emco House, 140, Wardour Street, London, W.—In response to a circular letter issued by Mr. O. Sunderland, of 15, Eastcheap, E.C., a meeting of the creditors of the above was held on December 22nd, at Winchester House, Old Broad Street, E.C. An approximate statement of affairs was presented by Mr. Sunderland, which showed liabilities of £23,447, including a claim by a gentleman who was at one time a partner in the business, but severed his connection with it some months ago. The preferential claims amounted to £572. The assets were estimated to realise £12,080. The principal assets were: Stock estimated at £6,000; book-debts, £5,000; and office furniture and fittings, £400. The deficiency was accounted for chiefly by losses on trading, together with depreciation written off the assets. Recently there were several suing creditors, and as one was in a position to sign judgment, it was decided that in order to preserve the assets, a deed of assignment should be executed with Mr. Sunderland as trustee. The position disclosed was discussed at some length, and eventually it was decided to confirm the deed already executed, and a committee of the principal creditors was also appointed.

Vanadium Production Suspended.—Mr. J. Leonard Replogle, president of the Vanadium Corporation of America, the leading producers of this rare mineral, authorises the statement that the American production of vanadium has been suspended. The reason for the suspension of production in that country is stated to be the fact that the company's Peruvian properties are producing enough vanadium to supply the world. At the same time the Vanadium Corporation, which controls from 90 to 95 per cent. of the world's output, is able to produce vanadium 10 to 15 per cent. purer than the American deposits, and can deliver it at Pittsburg cheaper than similar consignments shipped from the Colorado plant.—*Reuter's Trade Service* (New York).

Renewal Fee Payments on Patents.—The *Illustrated Official Journal* (*Patents*) of December 22nd directs attention to the fact that the extension of time provided by the terms of Article 307 of the Treaty of Peace with Germany, and also by Rule 3 of the Patents, Designs and Trade Marks (Temporary) Rules, 1914, will expire on January 10th next. Care should, therefore, be taken by patentees who desire to maintain their patents in force, to make the prescribed renewal fee payments which may be outstanding, with as little delay as possible, and so that they may be received at the Patent Office by January 10th, 1921. It should also be observed that in those cases where the renewal fee which became due after January 10th, 1920, has been paid (leaving in abeyance the fees due in preceding years), it will be necessary that all outstanding fees should be paid not later than January 10th, 1921.

For Sale.—By direction of the Disposal Board, Ministry of Munitions, the Controller, Plant and Machinery section, invites offers for one complete power station plant, comprising three 2,000-kw. generating sets, complete with boilers, pumps, &c. For particulars see our advertisement pages to-day.

A Power Company's Dinner.—The 20th anniversary of the establishment of the Lancashire Electric Power Co. was celebrated by a dinner in Manchester to the staff, and the chief engineers of the undertakings with which the company is linked up in South and East Lancashire. Dr. Parshall, chairman of the directors, who presided, said that from a position of cold isolation in the county, where it was at first opposed by the municipal authorities and treated as an interloper, the company had steadily grown to be of such important service to the districts which it supplied that the spirit of opposition and hostility had entirely disappeared. The local authorities were now co-operating to the fullest extent to make the best use of the electrical plant at their disposal.—*Manchester Guardian.*

Book Notices.—*L'Eclairage Electrique.* By L. Barbillion and P. Bergeon. Pp. 160; figs. 87. Paris: Albin Michel. Price 15 fr.—In this work the authors treat of the various types of incandescent and arc lamps from both the scientific and the practical points of view; to the mercury vapour lamp a whole chapter is given, and another chapter is devoted to non-electric systems of illumination for comparative purposes. Finally the subject of photometry is dealt with at considerable length. The work is concise and clear, and is suitable especially for the illuminating engineer.

"Electrical Scientific and Telegraph Instruments of British Manufacture" (31 pp.). London: B.E.A.M.A.—This valuable little pamphlet presents a general survey of the variety and scope of the apparatus manufactured by the members of the Scientific and Telegraph Instrument Section of "Beams" ("Beama Satis"), and indicates the range of measurement and degree of accuracy obtainable by their means. Among the apparatus dealt with are galvanometers, oscillographs, dynamometer instruments, instrument transformers, recording instruments, standard resistances, potentiometers, pyrometers, &c. It is intended to send a copy of the pamphlet to all important overseas technical training colleges, and "Beama Satis" will be glad to hear from any such who, desiring a copy, have not yet received one.

"*Mechanical World* Year Book" for 1921. Manchester: Emmott and Co. Price 2s. 6d. net.—Among the new sections introduced into this work is one on cast-tooth gearing, giving a number of tables, &c. The matter on chain-gearing has been re-written and extended. Other new features are sections dealing with ball and roller bearings, and with friction and lubrication. In the latter section are included data on the design of friction clutches, band brakes, &c., as well as notes on lubricants and lubricating methods.

Technologic Paper No. 175 of the U.S. Bureau of Standards, "Pouring and Pressure Tests of Concrete" (13 pp.). Washington: Government Printing Office. Price 5 cents.

"The Henley Telegraph." Vol. I, No. 4. Pp. 40. Price 6d.—The December issue includes a number of interesting articles, amusing notes, &c., and is very "readable."

"The Future of Industry." By E. W. Petter, M.I.Mech.E. Pp. 19. Yeovil: The Wessex Publishing Co. 1917. Price 3d. (20s. per 100).—This is a reprint from the *Western Chronicle* of a lecture delivered at the Guildhall, Bath, under the auspices of the Industrial League and Council.

"The Mathematical Theory of Electricity and Magnetism." By J. H. Jeans. Pp. vi + 627, 138 figs. Cambridge: University Press. Price 24s. net.

"Science Abstracts" (A. & B.). Vol. XXIII, Part 11, No. 275. November 30th, 1920. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each.

"Fundamental Principles of Electric and Magnetic Circuits." By F. A. Fish. Pp. xi + 193, figs. 106. London: McGraw Hill Book Co. Price 16s. 6d.

Electricity Supply Rifle Club Shoot.—The Shoreditch Electricity Supply Miniature Rifle Club enjoyed a most successful event on December 18th, this being the occasion of its second grand Christmas shoot.

Notwithstanding the weather conditions, there was a very large assembly, representing all sections of the borough's electricity supply undertaking, and including members of the Electricity Committee, who had very sportingly entered two teams.

The following were the winners of the various competitions:—

Competition No. 1.—Rapid shooting at 1-in. breakable disks, 25 yards' range:—Messrs. Love, Runham, Bruce, and Norden. Captained by Mr. L. Flavell.

Competition No. 2.—Rapid firing at ½-in. breakable disks, range 25 yards; time limit, 3 minutes:—Messrs. Ebner (captain), Ridd, Venables, and Dunsmore.

Competition No. 3.—Best score on 5-bull S.M.R.C. match targets:—Mr. W. Weekes.

Competition No. 4.—Similar competition to No. 3:—Mr. Venables.

The prizes consisted of two silver challenge cups for the winning teams of Competitions Nos. 1 and 2 respectively, and a very fine assortment of individual prizes, including medals, cake dishes, biscuit jars, walking sticks, tobacco pipes and pouches, &c.

Councillor J. H. Agombar, chairman of the Electricity Committee, distributed the prizes.

Messrs. Ercole Marelli & Co.'s Works.—We are informed that a rumour has got abroad that Messrs. Ercole Marelli & Co.'s factories at Milan have been destroyed; there is no foundation whatever for this supposition, the factories being in perfect order and extremely busy. During September the works were occupied by the workmen, like all the other large works in Lombardy, but early in October they were handed back to the owners; during the occupation work had been carried on practically in a normal manner, and the plant was absolutely undamaged.

Spanish Electrical Manufacturers' Association.—The Catalonian manufacturers of electrical material and apparatus have formed at Barcelona a union called the Associacion Industriales Electristas y Anejos de Cataluna. One of the chief objects of the Association, apart from the protection which the manufacturers hope to find in the new Customs tariff, will be to obtain facilities from the Government for the export of their products.—*Reuter's Trade Service* (Madrid).

New Bombay Electrical Vehicle Company.—The formation is announced of the Transit Engineering Co., Ltd., with a capital of 50 lacs of rupees. The registered office of the new concern is York Buildings, Hornby Road, Bombay. The company has been floated for the purpose of importing into India, and dealing in, electric vehicles of all kinds, including pleasure vehicles, lorries, and industrial trucks.—*Reuter's Trade Service* (Bombay).

Non-Ferrous Metals.—In view of the violent fluctuations in the quotations of the principal non-ferrous metals which took place on the Metal Exchange last week, the *Financial Times* gives the following table showing the stocks at London and other ports of the United Kingdom, compiled by the London Metal Exchange Statistical Department:—

	Nov. 30th. Tons.	Oct. 31st. Tons.
Copper, refined	9,388	9,604
" rough	2,051	3,968
" unclassified ...	182	182
Total ...	11,621	13,754
Tin	4,693	4,025
Lead	14,919	15,355
Spelter	16,953	19,214

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods connected with the electrical trades and industries:

Electrilac. No. 396,028. Class 1. Electrical insulating varnish. Arthur G. Brown, trading as the Rustnot Co., 73, Bridge Street, Manchester. October 14th, 1919.

Vioray. No. 405,483. Class 13. Arc lamps. B. J. Hall & Co., Ltd., Peters Street, Westminster, and A. W. Penrose & Co., Ltd., 109, Farringdon Road, London, E.C. July 7th, 1920.

Bee Bee Sparking Plug Bruntons (lettering combined with design). No. 404,322. Class 13. Sparking plugs. Bruntons, Wire Mills, Station Road, Musselburgh, N.B. May 20th, 1920.

Beru. No. 406,448. Class 13. Sparking plugs. Waddington Bros., 625-7, Fulham Road, London, S.W. 6. July 26th, 1920.

Wolseley. No. 403,117. Class 6. Electric motor and generators. Wolseley Sheep Shearing Machine Co,, Ltd., Alma Street, Aston, Birmingham. April 20th, 1920.

Rubis. No. 408,002. Class 13. Sparking plugs. Pelabon, Ltd., Cambridge Road, Twickenham, S.W. September 20th, 1920.

Belling. No. 380,413. Class 18. Electric cooking and heating apparatus. Chas. R. Bell, trading as Belling & Co., Derby Road Works, Edmonton, London, N. August 21st, 1919.

New Belgian Company.—La Société des Ateliers Electro-Mecaniques Bauduin is the name of a new company which has lately been formed at Marcinelle-Charleroi, with a capital of one million francs, to carry on an electrical engineering business.

New French Company.—La Société Hydro-Electrique "La Valentinoise" is the name of a new company which has lately been formed in Paris (5, Rue de Vienne), with a capital of one million francs.

Swedish Trade Propaganda.—The Swedish Ministry of Trade has appointed a Committee to inquire into and submit recommendations regarding steps to be taken to ensure the greatest possible uniformity and effectiveness in Swedish commercial information. In accordance with the terms of reference, the Committee is to be guided by the principle that existing official and private institutions should be utilised as far as possible for the purpose of disseminating commercial information. It is stated, H.M. Minister at Stockholm adds, that the duties of the Committee will include the drawing up of a scheme of propaganda for Swedish goods abroad, as well as the organisation of centres of information regarding foreign goods suitable for the Swedish market.—*Board of Trade Journal.*

Rio Tinto Copper Mines.—The strike at the Rio Tinto mines has now been settled, the miners accepting the English company's conditions. The strike lasted six months, and was kept alive by foreign and native agitators.

Australian Lead Mines.—Work has been suspended at the Broken Hill South Mine, on account of the fall in price of lead and zinc.

Unemployed in the United States.—According to a *Daily Telegraph* correspondent, the American Labour associations estimate that there are nearly 2,500,000 unemployed in the United States at the present time, and that the number is growing. Owing to the high cost of living, very few saved during prosperity for a rainy day, and many spent all they had saved, deluded by the idea that prosperity would continue for many years.

Reduction of Wages in Sweden.—It is reported that two big engineering works have notified their staffs that they find it necessary to reduce wages by 22 per cent. If the workmen refuse to accept this reduction, a large part of the staff will be dismissed.—*Reuter's Trade Service* (Stockholm).

Dalmarnock Bowling Green.—The use of ground at Dalmarnock Gardens, Glasgow, is to be granted as a bowling green for the employés of the Corporation electricity department, and £400 has been granted towards the cost of making the green.

German Lamps for Russia.—It is reported in Petrograd that large orders for manufactured goods have been given to Germany, including 750,000 electric lamps.

War Dumps Sold.—The Ministry of Munitions announces that the four largest British depôts remaining in France have been sold. The dumps in question are those at Audruicq (railway materials), Beaurainville (railway repairs), Abancourt and Le Havre (engineering stores), and the plant and stores include electrical material. The purchasers are Messrs. L. Aldridge & Co., Ltd., and Hughes & Bolckow, of Middlesbrough; the purchase price is understood to be considerably over £2,000,000.

Peru's Centenary Celebrations.—The exhibition proposed in connection with the Peruvian Centenary celebrations, which seems to have hung fire at the outset, will take place, it is now officially announced, at Lima from June 1st to October 31st, 1921. Though privately organised, it will have the direct support of the Peruvian Government. British participation is invited and, in fact, strongly recommended by the British Government trade officials both at home and in Peru. This especially applies to manufacturers of "luxury articles," which should find a ready market. It is expected that the exhibition will attract a number of American exhibitors.—*Financier.*

Rates of Exchange.—Both the Prime Minister and Sir Robert Horne informed the House of Commons on December 20th that it was the intention of the Government to include in a Bill, to be introduced at the beginning of the next session of Parliament, provisions dealing with the situation caused by the importation of goods at abnormally low prices owing to the state of certain exchanges.

Russian Trade.—Urgent requests to resume trade with Russia, in the hope of alleviating unemployment in this country, were addressed to the Government by the Labour Party in the House of Commons on December 22nd. Sir Robert Horne, replying, said:—"The real fact is that Russia has got no commodities to trade with. The one commodity she has got is gold." The Government had been eager and anxious to resume trading relations with Russia, but it was very difficult to conduct trade which did not depend upon an interchange of commodities. Most definite propaganda, organised in Russia, hostile to British interests in the East, was, he said, being conducted. On June 30th the Soviet Government accepted the conditions with regard to ceasing Sropaganda, and the Government proposed to insert them into the agreement, in order that the Russian Government should show its good faith. While believing an agreement would be reached, he said that if it were not, British traders would be free to trade with Russia at their own risk, as other countries were trading with Russia. But the volume of trade with no country had reached any considerable dimensions.

Annual Dinner.—On Saturday, the 18th inst., the staff of Electrical Installations, Ltd., held their 10th annual dinner at the Holborn Restaurant, which was attended by some 90 members of the staff and the directors of the company, Mr. H. F. Simon, managing director, taking the chair. The dinner was followed by an excellent professional concert.

The Athletic and Social Club of Electrical Installations, Ltd., which has been in existence for a number of years, has held a considerable number of concerts and successful social evenings during the past season, which in every case have been well attended.

Tramway Wages Inquiry.—Employers and the Unions concerned have concurred in the decision of the Ministry of Labour to set up a court of inquiry in connection with the disputed claim for an increase of 12s. a week for tramway workers all over the country. Representatives of the Municipal Tramways Association met in London on December 21st, and decided that they would be represented at the inquiry. Mr. J. Beckett, secretary to the Association, said that he understood that the constitution of the court and the terms of reference had not yet been decided upon by the Ministry. The private companies represented through the Tramways and Light Railways Association have also decided to state their case before the court of inquiry.—*Daily Telegraph.*

The National Executive Council of the United Vehicle Workers' Union has refused to sanction the application of the Manchester and the Salford tramway men to put in a claim for an increase of wages of £1 a week. This decision was communicated to a meeting of representatives of the Manchester men's branches, which resolved that any further action should be deferred till after the national inquiry. The Executive Council's decision was conveyed in the following resolution:—"That having carefully considered the application of the Manchester and Salford branches, and the views put forward by the delegation for the purpose of making a local application for an increase of wages, the E.C. are of opinion that such an application would be fruitless, and would have a detrimental effect on the forthcoming inquiry."—*Manchester Guardian.*

New Kinema Invention.—A new invention has been placed on the market in Sweden and introduced in Stockholm film theatres by Aktiebolaget Plantkran. The new device, which is named "Peco," consists of an electrically-propelled fanning appliance for keeping a film cool and doing away with the danger from fire. If a film should take fire, it is claimed that the new appliance immediately extinguishes the flame.—*Reuter's Trade Service* (Stockholm).

LIGHTING AND POWER NOTES.

Aldershot.—Military Undertaking.—The Secretary of State for War, replying recently to a question put to him in the House of Commons, stated that the area in which it was proposed to supply electricity from the Command generating station was outside the area in which the Aldershot Gas, Water and District Lighting Co. had the right to supply. He also stated that the military undertaking paid the equivalent of local rates, although not legally liable.

Australia.—W.A. Government Undertaking.—It is stated that the electricity undertaking owned and operated by the Western Australian Government showed a profit of £4,064 for the year ended June 30th, 1920.

Sydney.—The municipality has requested the Government to set up an independent tribunal to fix the prices to be charged for electricity. The profit on the undertaking for 1919-20 was £19,000, but it is estimated that if prices are not increased there will be a loss of £60,000 on the working for the current financial year, due chiefly to enormous increases in employés' wages.

The Morwell Scheme.—Sir John Monash, chairman of the Victorian electricity commissioners, states that all the plans and specifications and conditions of contract for the whole of the electrical parts for the first instalment of electric power at Morwell would shortly be lodged with the best makers in the world—both in England and Australia. These parts would include turbo-alternators, condensing plant, switchgear, transmission-line towers, cables and the like. Plans and specifications for boiler plant were also in hand, but they were not so urgent. At the present time plans were being made for the diversion of water for condensing purposes from the River Latrobe. The commissioners had in view the organisation and construction of a garden township. The township would be sewered, with a proper water supply, and would be electrically lighted.—*Tenders.*

According to *The Times*, coal is scarce owing to the shipping strike, and the Federal Government has prohibited the use of gas and electric light and power except within severely restricted hours. In Melbourne the tramways are likely to be shut down after sunset and on Sundays.

Banffshire.—Hydro-Electric Scheme.—At a meeting of the County Council the Finance Committee submitted a report dealing with the county scheme for the generation of electricity by water power. It was decided to appoint Messrs. Balfour, Beatty & Co. as consultants to report upon the scheme, at a remuneration of £400. Mention was made of the intention of certain bodies to effect a diversion of the Spey and its tributaries for electrical purposes, and it was, therefore, resolved to ask Parliament not to sanction such schemes, as they were prejudicial to the county's interests.

Barnoldswick.—Proposed Electricity Supply.—The District Council is considering the installation of an electricity supply for the town, and has arranged meetings with the Nelson Corporation to discuss the matter.

Barnsley.—Lighting Failure.—On the night of December 21st the whole of the Corporation's electric lighting failed, causing great inconvenience to theatres and kinemas. After over an hour's stoppage the supply was resumed.

Bedford.—Year's Working.—The accounts of the municipal electricity undertaking for the year ended March 31st last record a total revenue from all sources of £61,311; last year's figure was £49,983. Against this, working expenses amounted to £43,697, compared with £38,084, leaving a gross balance of £17,614 (£11,899). The payment of loan charges, &c., resulted in a net profit of £2,628, being very nearly the same as in the previous year, when the profit was £2,791.

Bethesda (N. Wales).—Proposed Electric Lighting Scheme.—At a meeting of the Urban Council the question of obtaining an electricity supply was raised. The clerk stated that he had been in communication with the North Wales Power Co., and, as a result, was able to give a figure for the cost of supplying within a radius of four miles. This was £11,000, and a price of 2d. per unit would be asked. It was decided to proceed with the matter.

Bexhill.—Inadequate Supply.—The load on the Council's station is so great that new services for radiators have to be disallowed, and no additional street lighting can be entertained. The Council recently approached the Hastings Corporation, inquiring what progress was being made with its scheme for bulk supply; but the position of this scheme is unlikely to render plant extensions unnecessary at Bexhill. While it is felt that the strain of this winter may be met with care, the Committee considers that action must be taken early in 1921. The Electric Light Committee has decided to seek the advice of the Electricity Commissioners in the matter, to again approach Hastings Corporation respecting the bulk supply scheme, and to obtain information respecting the purchase of generating sets, new and secondhand.

Bournemouth.—Lighting Contract.—At a meeting of the Town Council the proposal of the Bournemouth and Poole Electricity Supply Co., to light the streets of the town as far as the mains extended, was rejected. The lighting contract with the Bournemouth Gas and Water Co. was renewed.

Bromley (Kent).—FAILURE OF LIGHTING.—Owing to a defect in the main cable of the electric light supply at Bromley Kent, on December 22nd, the town was in comparative darkness, for some time. The supply failed shortly after four o'clock, and the local kinema houses had to curtail their programmes, whilst nearly all the shops were illuminated by oil lamps and candles. Later the electricity supply was restored.

Bury.—LOAN SANCTIONED.—The Electricity Committee has received the sanction of the Electricity Commissioners to the borrowing of £95,000 for the extension of plant at the Chamber Hall power station.

Colwyn Bay.—LOAN.—The Electricity Commissioners are being asked to sanction the borrowing of £48,224 by the Urban District Council. This is required for the provision of machinery, plant, cables, and building extensions in connection with the bulk supply to be given by the Aluminium Corporation at Dolgarrog.

Continental.—FRANCE.—An incident similar to that which took place some time ago, when the Town Council of Metz, passing over French firms, placed orders for electricity meters with the A.E.G., has occurred recently. The Société d'Électricité, of Strassburg, passing by French tendering firms, has placed its orders for boilers with German firms. There is, however, a difference in details between the two incidents, for whereas in the former the German quotation was much below the French one, in the present instance the reverse is the case. The former incident, when it occurred, called forth some very natural criticism on the absence of patriotism and gratitude, in order to make a saving of a few hundred francs; the latter shows no such justification, and seems a case of sheer lack of patriotism.

Work is proceeding satisfactorily in the construction of the high-pressure power distribution system which is to make the devastated regions independent of direct coal supplies. It will save labour, benefit the small workshop owner, and eventually reduce the country's importation of coal. It is expected that the scheme will be completely carried out by the end of next year. Among the towns to receive electricity when it first becomes available are Douai, Valenciennes, Lille, Cambrai, Laon, Rheims, Epernay, Verdun, Longwy, and Nancy. All other cities and villages will be supplied ultimately, and the North and East will be linked up with Alsace and Lorraine. The principal power station is to be at Hirson, power being supplied later from Gennevilliers and stations on the Rhine.—*The Times Trade Supplement.*

The Conseil-Général du Pas-de-Calais has requested that negotiations be entered into with all the supply companies to the end that electricity may be placed at the service of every commune in the Department.

GERMANY.—The British Commercial Secretary at Cologne has forwarded to the Department of Overseas Trade the following translated extract from the *Deutsche Bergwerks Zeitung* of December 21d:—

"Ten of the largest electricity works supplying the Westphalian industrial and neighbouring district have united in the Kommunalen Electrizitatswerkverband (K.E.V.), Westphalia, which has its seat at Hagen. Eleven electricity works belong to this union. The chief tasks of the company are the technical co-operation of the power stations at present existing in the union, the joint building and working of new water and steam-power works on the basis of the cheapest fuel, and to ensure a good and sufficient supply of electricity in the future. The great question of the day is how to supply communities and industries with sufficient electricity. Bituminous coal is scarce, and, consequently, there is a shortage in electricity; the coal supplied by the State is insufficient, and the Association has taken certain measures in order to supply these much-needed wants. It is to give mutual help and support to other existing power stations; to extend suitable water-power stations; and to bring large quantities of electricity from the Rhenish brown coal district. The Association also plans for the construction of a large power station with a coal supply of its own. The Bergwerkgesellschaft Lothringen, Gerthen, near Bochum, has joined the K.E.V. in connection with the coal supplies to the K.E.V. The Ruhrtalsperrverein will also probably join the Association for the purpose of co-operating in building a large water-power station."

ITALY.—There has been introduced into the Senate, by the Ministry of Public Works, a draft Bill for the constitution of an autonomous body for the development of the hydraulic forces of the Adige and the Garda. The draft Bill authorises the Provinces of Verona, Mantova, Modena, and Bologna to set up a corporation for the direction and utilisation of the water resources of the basins of the Adige and the Garda and their feeders, and other basins of the same provinces, the plants to be installed being as in the Bill prescribed. To the corporation may be joined other public institutions and bodies not only of the provinces mentioned, but also of Venezia Tridentina. The capital of the corporation is not fixed, and it has the power of issuing bonds. The vastness of the river systems dealt with makes this scheme one of great importance.

SPAIN.—During the recent strike riots in Seville many attempts were made to destroy the electric supply cables, but they were effectively frustrated by the Civic Guard.

Edinburgh.—NEW STATION.—At a meeting of the Town Council on December 22nd, it was stated that the present estimated cost of machinery and plant for the Portobello Station was £633,000, an increase of £143,000 upon the estimate submitted two years ago. Some dissatisfaction was expressed that the scheme had not been commenced when the first estimates were presented, but the inability of the Council to do this was said to be due to the Government not removing the "priority" demand in January, 1919. The total cost of the Portobello scheme is estimated at £1,750,000. The report submitted by the engineer upon this subject was "received," but not formally approved.

Electricity District.—MERSEY AND WEST LANCASHIRE.—In pursuance of a notice issued by the Electricity Commissioners on July 16th, 1920, of the provisional determination by them of the above-named district, the Commissioners give notice that they will hold a local inquiry at the Town Hall, Liverpool, on January 25th, 1921, and following days with reference to the area to be included in the proposed district, and the objections and representations which have been made on account of the inclusion in or exclusion from the district of certain areas, and to consider (*a*) a scheme which has been submitted by a conference of Mersey and West Lancashire Electricity Authorities for effecting an improvement of the existing organisation for the supply of electricity in the said district, and for the formation of a Joint Electricity Authority; and (*b*) a scheme which has been submitted by the Corporation of Wallasey for effecting an improvement of the existing organisation for the supply of electricity in the Wirral District and for the formation of a Joint Electricity Authority. Copies of the respective schemes may be obtained (*a*) from Mr. E. W. Pierce, Town Clerk's Office, Municipal Buildings, Liverpool, and (*b*) from Mr. H. W. Cook, Town Hall, Wallasey, at a cost of 2s. 6d. each.

Any representations or objections with regard to the said schemes or either of them should be addressed to the Secretary, Electricity Commission, Gwydyr House, Whitehall, London, S.W. 1, not later than Tuesday, January 18th, 1921, and a copy of such representations or objections should at the same time be sent to Mr. E. W. Pierce, or Mr. H. W. Cook, as the case may be, at their addresses mentioned above.

Grimsby.—PROPOSED EXTENSIONS.—The Electricity Committee, on December 15th, considered a scheme of extensions estimated to cost £200,000. It was stated that extensions were imperative, as the present plant was seriously overloaded. The proposals were eventually referred to a Sub-Committee for consideration and report.

Guildford.—SALE OF UNDERTAKING.—The Town Council is applying for a special order to authorise the Guildford Electricity Supply Co., Ltd., to transfer its undertaking to the Corporation, and for powers to generate and supply electrical energy.

Halifax.—YEAR'S WORKING.—The total revenue of the electricity works for the year ended March 31st last, was £137,832, compared with £111,574 in the previous period. Working expenses amounted to £80,752, as against £72,293, leaving a gross profit of £57,080 (£39,281). The net result after payment of all capital charges, was a profit of £23,997, a considerable improvement upon last year's balance, which was £9,033, although the number of units sold fell from 18,029,244 to 16,161,399.

Harpenden.—PROTEST TO COMMISSIONERS.—Until the passing of the Electricity (Supply) Act, 1919, it was the intention of the Urban District Council to take a supply of electricity from Luton Corporation. When, however, the district for that part of the country was delimited, it was found that Harpenden was included in the Greater London Area, while Luton was excluded. It has, therefore, been decided to forward a protest to the Electricity Commissioners against being supplied from any station several miles away from Harpenden, and to point out that the most advantageous and economical source of supply is the Luton undertaking.

Holyhead.—ELECTRICITY IN HARBOUR.—The London and North-Western Railway Co. has decided to electrify a large quantity of the plant at the harbour in connection with the Dublin route improvements. Electric cranes and capstans are to be installed.

Kilmarnock.—YEAR'S WORKING.—The accounts of the Corporation electricity department for the year ended May 15th, 1920, show a total revenue of £78,945, as compared with £59,576 for 1918-19. The total working expense was £56,421, as against £35,529 in the previous period, leaving a gross balance of £22,524 (£24,047). The payment of capital charges left a net profit of £961. The previous year's balance was £5,858. The number of units sold rose from 12,193,102 to 13,495,483.

Lanark.—PROPOSED ELECTRICITY SCHEMES.—Four schemes for the supply of electricity to the town were brought forward at a Council meeting by the Committee appointed to deal with the question. The first of these was a bulk supply from the Clyde Valley Power Co. This was estimated to require an initial capital of £58,000, and working expenses, &c., would amount to about £18,000 per annum. A scheme to utilise the power of the Clyde was estimated to cost £45,000, with annual charges amounting to £5,590. The other suggestions were to install steam turbine sets at a cost of £48,000, or gas or oil engines costing £30,000, with annual charges of £8,348 and £4,130 respectively. Mr. J. M. M. Munro, the expert appointed, suggested that the water-power scheme should be adopted. Finally, however, the Council decided to defer the whole question on account of the prohibitive cost of all the schemes, but the report is to be submitted to the Electricity Commissioners for their information should they desire to provide electricity to the county.

Liverpool.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing of £100,000 by the Corporation for the purpose of extending the generating plant.

London.—Battersea.—The Borough Council is installing two 450-kw. mercury-vapour rectifiers, at a cost of £7,903, for the conversion of the supply to the Nine Elms district.

Mytholmroyd.—Electricity Supply.—Mr. W. Emmott, Halifax, has been appointed consulting electrical engineer to the Mytholmroyd Urban Council, and a committee has been deputed to open up negotiations with the Lancashire Electric Power Co. for the supply of electricity to the district.

New Zealand.—Rotorua Extensions.—In connection with the Rotorua electric power scheme the demand has outgrown the capacity of the plant, and it has been decided to increase this capacity by the construction of a power station at the trout pool at a suitable site about three-quarters of a mile down the Kaituna River from Lake Rotoiti. While the plant to be installed there will be sufficient to supply the immediate needs of Rotorua and district, provision is being made for its suitable extension to the full capacity of the site, about 10,000 h.p. A complete contour survey has been made, enabling the access road, tunnel pipe-line, and power house to be located, and detailed plans of the work will be proceeded with as early as possible. The power from this source will ultimately be linked up with Arapuni or the Waikato scheme on the west, and the Waikaremoana scheme on the east, thus giving a completely connected system.—*Auckland Weekly News.*

Norwich.—Sub-stations.—On December 21st the City Council adopted a recommendation of the Electricity Committee to purchase the necessary land for the erection of two sub-stations.

Plymouth.—Street Lighting.—Owing to the number of complaints received from nightworkers and others of the danger of the unlighted streets in the early morning, the Electricity and Street-Lighting Committee has decided to suspend the war regulations and maintain the lighting throughout the night.

Portsmouth. — Loan. — The Corporation is seeking sanction to the borrowing of £91,000 for the purpose of extending the generating plant. Tenders submitted by the Metropolitan-Vickers Electrical Co. and Messrs. Babcock & Wilcox having been approved, the firms are being asked to proceed with the work.

Scarborough.—Breakdown.—Owing to the failure of one of the lighting cables, the centre of the city was in darkness for about two hours on December 20th.

Scotland.—Grampian Hydro-Electric Scheme.—The hydro-electric scheme formulated by the Grampian Electricity Supply Co. is fully detailed in a provisional order, a draft of which has recently been submitted to the Private Legislation Procedure Committee. An initial capital of £1,000,000 is provided for, and powers to increase this to any further sum not exceeding £4,000,000 are sought. Fifteen lochs and about 100 smaller waters are included in the area, and five generating stations to supply electricity within an area comprising the counties of Perth, Forfar, and Kinross, and parts of the counties of Inverness, Argyle, Stirling, and Dumbarton are to be erected.

South Africa.—Bulawayo.—The new generator at the power house in Bulawayo burst when put into commission for the first time after undergoing the tests. The switchboard is partially wrecked, and the town without electricity. The damage is estimated at £5,000.—*Reuter's Trade Service* (Cape Town).

Southend.—Inadequate Lighting.—For a considerable time the electric lighting in the town has been the subject of complaints from tradesmen and others. It is stated that although the plant capacity has decreased since 1914, there are nearly a thousand more consumers. It is hoped to put a new auxiliary generating station at Leigh into service shortly.

Swansea. — Short Strike. — The electrical fitters employed at the municipal electricity works struck work on December 22nd, but returned to duty the following day.

United States.—Niagara Dam.—A plan to dam the Niagara River below the whirlpool is advocated by Dr. T. K. Thomson, of New York, who declares that the new 100-ft. fall thus produced would furnish 2,000,000 h.p.—*The Times.*

Watford. — Change of Supply. — The Northwood Electric Light and Power Co., Ltd., has applied to the Rural District Council for permission to change the supply in the district from continuous to alternating current. The Council has decided to wait for representations from consumers before coming to any decision on the matter.

Yeovil.—Time Extension.—The General Purposes Committee reported to the Council that it had received from the Electricity Commission an intimation that Messrs. Petters, Ltd., had applied under the Special Acts (Extension of Time) Act, 1915, for a further extension of nine months within which to lay down the mains for the purposes of general supply of electricity under the Yeovil Electric Lighting Order, 1914. The Committee had replied that no objection was offered to such extension, but expressed the hope that the undertakers would very shortly make an effort to put the work under the Order in hand.—*Western Gazette.*

TRAMWAY AND RAILWAY NOTES.

Australia.—Sydney Accident.—On November 7th an accident, which caused the death of one person and injuries to 40 others, occurred on the Marne Park section of the Sydney tramway system. As a car was proceeding along the Anzac Parade the pole suddenly slipped the trolley wires, putting the car in darkness. The driver of a second car, which was following the first, was unable to pull up in time, and a violent impact took place, which forced the disabled car a distance of several yards. The emergency brakes on the second car failed to act, and, continuing in its course, it struck the leading car a second time, breaking into the rear and causing serious damage. The conductor of the first car was crushed between the cars, while endeavouring to replace his trolley, and was killed.

The State Government of New South Wales has decided to resume the construction of a tube railway system for Sydney and a section of its suburbs, and preparatory work will be started for building a bridge across the harbour at an estimated cost of £5,000,000, spread over a period of 10 years.—*The Times.*

Belfast.—New Cars.—A new type of car has been recently introduced on the Corporation tramway system. The new cars, of which 50 have been ordered, are larger than the existing type, carrying 68 passengers—26 inside and 42 outside—as against 56 by the cars in use. The high-pressure signalling arrangement is unique, and the first of the kind to be introduced in Europe. The signals consist of a buzzer for the conductor and passengers, and a single bell for the conductor only.

Blackpool.—Year's Working.—The report upon the Corporation tramways for the year ended March 31st last, which includes figures for the Fleetwood undertaking as from January 1st, 1920, shows a total revenue from all sources of £186,474, as compared with £144,535 for 1918-19. Working expenses amounted to £147,769, as against £93,639, leaving a gross credit balance of £38,705 (£50,896). The payment of loan charges, &c., £23,122, left a net profit of £15,583, a considerable decrease from last year's figure—£33,052. The car-mileage increased from 1,242,107 to 1,447,226.

Bradford.—Collection of Fares.—At a meeting of the City Council a resolution for the discontinuance of the practice of collecting fares on the platform of top-deck passengers was proposed, but after a prolonged discussion the decision was deferred pending a conference with the men on the question.

Continental.—Italy.—The Consiglio Superiore delle Acque has expressed its approval of the scheme for the electrification of the Santhia to Biella Railway. This is one of the lines relegated for conversion to private industry. Continuous current at high pressure will be used.

Egypt.—Cairo.—A novel substitute for the strike weapon has been originated by the Cairo tramwaymen, who are dissatisfied with working conditions. The men, however, lack funds for a strike, so the drivers have adopted the policy of so manipulating the switches that fusing is caused. The repair gangs are acting in concert with the drivers, and delay repairs to such an extent, that a reduction of the service is necessary. The men thus succeed in decreasing the company's returns, but retain their normal rate of wages.—*Electric Railway and Tramway Journal.*

Falkirk.—Transfer of Undertaking.—It is announced that a provisional agreement has been entered into between the Falkirk District Tramway Co. and the Fife Tramway, Light and Power Co., by which the latter is to take over the whole of the Falkirk tramway system.

Finchley.—Collision.—On December 19th a tramcar collided with a motor-car on the Great North Road, resulting in the death of one of the occupants of the motor and the injury of two others. It is stated that the car caught in the tramway lines, skidded, and was thrown violently against the tramcar.

Glasgow.—Extensions.—Important extensions of the tramways are to be undertaken, including a route over a new bridge to be constructed across the Clyde.

Huddersfield.—Workmen's Tickets.—A proposal was submitted at a recent Town Council meeting for the extension of the hours for the purchase of workmen's return tickets to 9 a.m., as most of the workpeople are working much shorter hours, and the majority not commencing work till 9 o'clock. The matter is to be considered by the Tramways Committee.

Japan.—Tokio Underground Railway.—The Tokio Underground Railroad Co., organised some time ago, has received a permit from the municipal authorities to purchase land and start surveying preparatory to the construction of the projected line between Shinagawa and Asakusa. The work was to be commenced on December 1st, and the tunnelling early next summer. Negotiations to secure foreign capital from America are making fair progress, and, if this is forthcoming, in June next the company will increase its capitalisation from 20,000,000 yen to 80,000,000 yen.—*Reuter's Trade Service* (Tokio).

London.—Hammersmith.—The L.C.C. has sanctioned the borrowing of £9,936 for the purchase of six 3½-ton electric vehicles for the collection of house refuse. The Council having decided to accept the tender of the Westinghouse Cooper-Hewitt

Co. for the supply of three mercury vapour rectifiers, each capable of charging two vehicles, application is to be made for sanction to borrow £788 to cover the cost of these with the necessary switchgear, &c.

Accident.—Six persons were injured in a tramway-car collision at Holloway, N., on Sunday last; failure of the brakes on one of the cars is stated to have been the cause of the accident.

L. & N.-W. Railway.—Rumour Denied.—A rumour that the London and North-Western Railway Co. is considering a scheme which is likely to result in the electrification of the section of the railway between Chester and Holyhead, and that the scheme has some connection with the great electrical development which is to take place in North Wales, is not substantiated by railway officials at Chester, some of whom regard the project as being out of the question altogether.

Palestine.—Tramways Prohibited.—Mr. Ronald Storrss, Governor of Jerusalem, in his efforts to preserve the historical and religious features of the country, found it necessary to refuse the request which was made some time ago for a concession to run tramway cars from Jerusalem to Bethlehem and the Mount of Olives.

Taunton.—Purchase Declined.—In consequence of the Town Council's decision to charge the Electric Traction Co. more for its power, the company offered to transfer the undertaking to the Council for the sum of £7,000. On the surface this would appear to have been a remarkably reasonable figure, but it was stated at a Council meeting that if the system was presented gratis to the town the transaction would be an unprofitable one, as under present conditions, it would be impossible to make it pay. The capital sunk in the undertaking amounts to £35,000. The company threatened if the offer was refused to discontinue the service altogether.

York.—Railless Cars.—The new trackless car service between Pavement and Stockton Lane, Heworth, was commenced on December 22nd. The distance is a mile and a quarter, and two cars are running, each seating 26 persons.

TELEGRAPH AND TELEPHONE NOTES.

France.—Telegraphists' Strike.—The telegraph service between France and other countries, chiefly Britain, Italy, and the East, is disorganised by a "keep-to-the-rules" strike of telegraphists in protest against a Ministerial decree altering the conditions of their daily duty, says the *Daily Mail*. Thousands of urgent telegrams and cables for the Eastern Telegraph Co.'s station at Marseilles, and messages from New York to London *via* the French route were being sent on by post last week.

The Chamber of Commerce of Calais has requested the Minister of Commerce to establish a second telephone line between Calais and Paris.

L.C.C. Tramway Telephones.—Extensions.—The L.C.C. is considering the provision of an improved private telephone system with a view to minimising the delays which occur in dealing with breakdowns on the Council's tramway system. The existing system provides for only 24 "external" telephones which are in direct communication with the central exchange, although at 134 points there are "internal" telephones enclosed within feeder pillars from which communication is limited to the local sub-station. Calls cannot be received at these pillars. On a number of sections the distance between points provided with external telephones varies from 1¼ to 3¾ miles, and in the event of breakdowns on these sections, delay in obtaining the necessary assistance is sometimes caused, as the only telephone available is one of the internal type. It is proposed that the selector telephone control system, which is in operation on the West Ham Corporation tramway system should be installed. In addition to providing for selector stations, which can either call or be called as in the case of the existing "external" telephones, the system permits the inclusion of non-selector stations which can call, but which cannot be called from, the control office. The principle of the system is that the controller shall be in immediate touch with, and shall record all items of importance occurring on the system, this information being readily accessible to those in authority. It is suggested that the non-selector pattern of telephone, which is cheaper than the selector type, should be provided at intermediate traffic points. This will enable calls to be made direct to the controller at the tramway offices and a non-selector station can be connected with a selector station. The Council is of the opinion that this system would facilitate the working arrangements and would be of assistance in dealing with breakdowns, and proposes that in the first instance the system should be installed on the northern tramways, leaving its extension to the southern lines for consideration at a later date. The cost is estimated not to exceed £6,311, and the work could be completed in about nine months. No expenditure will be incurred during the current financial year.

Tahiti.—Wireless Communication.—A wireless station has been constructed at Mahina, Tahiti, for the purpose of opening up communication with Bordeaux. Results up to the present, however, have not been satisfactory, and further attempts will be made after a more thorough survey of atmospheric conditions has been carried out.—*Reuter's Trade Service* (Paris).

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Queensland.—January 26th, 1921. P.M.G.'s Department. Telephone apparatus and parts. Schedule 509. (December 10th.)

Sydney.—January 31st. Municipal Council. H.T. and L.T. cable (specification No. 628). Electric Lighting Department, Town Hall, Sydney.

Bulgaria.—Department of State Railways. Telephone and telegraph material, complete electrical installation and apparatus for coal mines. Lists can be seen at the Enquiry Room of the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

Edinburgh.—Corporation. Tuning and maintaining organ in Usher Hall for three years, including motors and switches, to the point of junction with Corporation mains, also all electric and electro-pneumatic connections. Conditions from Town Clerk.

India.—Meerut.—January 17th, 1921. Government of United Provinces hydro-electrical installation. Generating station equipment, including workshop equipment, H.T. transmission and distribution (overhead equipment, including poles), sub-station equipment, pumping station equipment and piping, &c. Mr. G. McHoey, sanitary engineer to the Government, United Provinces, Allahabad.—*Reuter's Trade Service* (Bombay).

Leyton.—January 11th, 1921. Urban District Council. Electric wiring of 142 houses on the Barclay estate. (December 10th.)

Manchester.—January 24th. Electricity Committee. Six motor-driven circulating-water pumps; three motor-driven boiler feed pumps and one motor-driven pump for weight-tank sump. (December 24th.)

January 11th. Tramway Committee. Electric welding equipment for the welding of tramway rail joints. J. McElroy, Manager, 55, Piccadilly.

Natal.—Durban.—January 26th. Corporation. Supply of telephone cable, paper sleeves, concrete pipes, and various telephone and miscellaneous accessories and materials.

February 16th. One 1,000-kw. rotary converter with transformers and switchgear. Specifications of the above may be consulted on application to the Department of Overseas Trade, 35, Old Queen Street, E.C.

New Zealand.—Napier.—January 17th. Borough Council. One 500-kw. electric generating set. Copies of the specifications and blue prints may be seen at the Department of Overseas Trade, 35, Old Queen Street, S.W.

Auckland. February 22nd, 1921. City Council. One 3,000-kw. H.T. turbo-alternator; two 5,000-kw. H.T. turbo-alternators; four 1,500-kw. rotary converters; four 500-kw. rotary converters, switchgear and transformers; four water-tube boilers, conveyor, pumps, pipework, H.T. and L.T. cables. (December 17th.)

Rhodesia.—Salisbury.—January 13th. Municipal Council. Electric generating plant, switchgear, cable and converters. Specification (£3 3s.) from the Council's Consulting Engineer, Royal Chambers, Johannesburg. A copy of the specification may be consulted at the Department of Overseas Trade (Room 48), 35, Old Queen Street, S.W.1.

South Africa.—Johannesburg.—January 18th, 1921. Rand Water Board. Supply and erection of steam boiler, superheater, stoker, economisers, &c., steam turbo driven centrifugal pumps, condenser, &c., for the Swart Kopjes pumping station. Copies of the specifications, &c., and forms of tender can be seen on application to the Machinery Section, Department of Overseas Trade, 35, Old Queen Street, S.W.

CLOSED.

Aylesbury.—Town Council:—

Edison Swan Electric Co., Ltd.—500 yd. of cable, £116.
W. Lucy & Co.—Joint boxes, 23s. each.

Belgium.—The municipal authorities of Ougrée (province of Liége) recently invited tenders for the establishment and equipment of a laboratory for the testing and standardisation of three-phase electricity meters. Only two offers were received, the lowest being that of the Société Belge pour la Fabrication des Compteurs, of Brussels.

Bradford.—The Tramway Committee has decided to recommend the City Council to accept the tender of a Belgian firm for 100 steel tramway tires at a price between 40 and 50 per cent. lower than the quotations of nine British firms.

Wrexham.—Town Council:—

Electric light wiring, Acton Park houses.—E. V. Walker & Co.

Government Contracts. — The following Government contracts have been placed during November, 1920 :—

Admiralty (Contract and Purchase Department).

Automatic telephone exchange equipment.—Siemens Bros. & Co., Ltd.
Batteries.—D.P. Battery Co., Ltd.
Bitumen.—W. H. Keys, Ltd.
Circuit breakers.—Whipp & Bourne, Ltd.
Electrically driven air compressor.—Bellis & Morcom, Ltd.
Electric light installation.—Foot & Milne, Ltd.
H. and L.T. cables and switchgear.—Johnson & Phillips, Ltd.
Lamps for night sights.—A. C. Cossor, Ltd.
Sheet mica.—Attwater & Sons.
Motor-driven angle bar cropping machine.—Craig & Donald.
Elements for radiators.—Automatic Telephone Manufacturing Co., Ltd.
Resistances for electric welding.—Bertram Thomas.

War Office.

Crucibles.—Morgan Crucible Co., Ltd.
Electrical equipment.—Pritchett & Gold and E.P.S. Co., Ltd.
G.I. wire.—Lancashire Wire Co., Ltd.

Air Ministry.

Switch boxes.—Park Royal Engineering Works, Ltd.
Transformers.—British Electric Transformer Co., Ltd.

Post Office.

Protective apparatus.—Phœnix Telephone & Electric Works, Ltd.
Telephone apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; Peel Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone & Electric Co., Ltd.; Western Electric Co., Ltd.
Telegraph and telephone cable.—Hackbridge Cable Co., Ltd.; Johnson and Phillips, Ltd.; Pirelli General Cable Works, Ltd.; Siemens Bros. and Co., Ltd.
Ducts.—Oates & Green, Ltd.; J. Woodward, Ltd.
Pole finals.—H. Workman, Ltd.
Condenser paper.—Brittains, Ltd.
Telephone pegs.—J. Hannan.
Telegraph poles.—C. Light & Co., Ltd.; Payne & Co.
Steel wire rope.—Whitecross Co., Ltd.
Lead sleeves.—T. & W. Farmiloe, Ltd.
Solder.—Quirk, Barton & Burns (St. Helens), Ltd.
Spindles.—Guest, Keen & Nettlefolds, Ltd.; T. W. Lench, Ltd.; C. Richards & Sons, Ltd.
Flexible cord connection.—H. J. Dawes.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated with the London Electric Wire Co. & Smiths, Ltd.).
H.D. copper wire.—British Insulated & Helsby Cables, Ltd.; R. Johnson Nephew, Ltd.
Switchboard wire.—British Insulated & Helsby Cables, Ltd.
Electric lift, G.P.O. (South).—Medway's Safety Lift Co., Ltd.
Laying conduits.—Dalston-Hackney: H. Farrow. Dundee: W. Dobson. Streatham-Norbury: H. Farrow. Lambeth (Borough Road), J. A. Ewart, Ltd. East Scotland Post Office Engineering District: Siemens Bros. & Co., Ltd. London-Barnet-Welwyn (London District): J. A. Ewart, Ltd. Finchley (Windermere Avenue): G. J. Anderson. Preston-Blackpool (Section III): S. Jowett & Sons.
Manufacture, supply, drawing in, and jointing cable.—Cardiff-Port Talbot: W. T. Henley's Telegraph Works Co., Ltd. Derby-Nottingham: British Insulated & Helsby Cables, Ltd. Birmingham-Wednesbury-Wolverhampton: Johnson & Phillips, Ltd. Marlborough-Reading: Callender's Cable & Construction Co., Ltd.
Power plant, Land's End wireless station.—New Pelaphone Engine Co., Ltd.
Telephone exchange equipment.— Hop: Western Electric Co., Ltd. Sunderland: Western Electric Co., Ltd. London exchanges.—Alterations to stock markings: Western Electric Co., Ltd. Cambuslang: Siemens Bros. & Co., Ltd. Sub-contractors: English Electric Co., Ltd., for charging machines; Tudor Accumulator Co., Ltd., for batteries.

High Commissioner for India.

Accumulators.—Chloride Electrical Storage Co., Ltd.
Cable.—W. T. Henley's Telegraph Works Co., Ltd.
Parts of dynamos.—J. Stone & Co., Ltd.
Generating sets.—W. H. Allen, Sons & Co., Ltd.
Motors.—Lancashire Dynamo & Motor Co., Ltd.
Switchboards.—British Thomson-Houston Co., Ltd.
Copper wire.—T. Bolton & Sons, Ltd.
Iron wire.—Rylands Bros., Ltd.
Wireless installation.—Marconi's Wireless Telegraph Co., Ltd.

Crown Agents for the Colonies.

Alternators.—Metropolitan-Vickers Electrical Export Co., Ltd.
Battery materials.—Western Electric Co., Ltd.
Boilers and economisers.—Babcock & Wilcox, Ltd.
Cables, &c.—Siemens Bros & Co., Ltd.
Copper conductors.—T. Bolton & Sons, Ltd.
Electric cables.—W. T. Glover & Co., Ltd.
Electric generator.—Laurence Scott & Co., Ltd.
Electric materials.—General Electric Co., Ltd.
Fans.—General Electric Co., Ltd.
Insulators, spindles, &c.—Bullers, Ltd.
Telegraph line material.—Siemens Bros. & Co., Ltd.
Telephones.—British L.M. Ericsson Manfg. Co., Ltd.
Telephone switchboards.—Western Electric Co., Ltd.
Train lighting equipment.—J. Stone & Co., Ltd.
Bronze and copper, &c., line wire.—Shropshire Iron Co., Ltd.
G.I. line wire—Rylands Bros. & Co., Ltd.

FORTHCOMING EVENTS.

Institute of Marine Engineers.—Tuesday, January 4th. At the Institute, The Minories. At 6.40 p.m. Paper on "The Internal Combustion Engine Gearing," by Mr. W. Pollock.

Institution of Electrical Engineers—South-Midland Centre (Students' Section).—Tuesday, January 4th. At the Institute, Birmingham. At 7.30 p.m. Address by the President of the Institution (Mr. Li. B. Atkinson).

Manchester Wireless Society.—Wednesday, January 5th. At the Albion Hotel, Manchester. At 7.30 p.m. Lecture on "Inductance Coils," by Mr. A. Parkinson.

Physical Society of London and the Optical Society.—Annual Exhibition. Wednesday, January 5th, and Thursday, January 6th. At the Imperial College of Science, South Kensington, S.W. From 3 to 6 p.m. and from 7 to 10 p.m.

Chelmsford Engineering Society.—Thursday, January 6th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Motor Transport Economics," by Mr. T. Clarkson.

Junior Institution of Engineers.—Friday, January 7th. At the Caxton Hall, Westminster. At 8 p.m. Lecturette on "The Indicator: Its Use and Application," by Mr. H. G. Pusey.

Royal Institution of Great Britain.—At Albemarle Street, W. At 3 p.m. Christmas Lectures—"The Haunts of Life"—by Prof. J. Arthur Thomson:—Saturday, January 8th. "The Conquest of the Land."—Tuesday, January 11th. "The Mastery of the Air."

NOTES.

The Electrical Engineers' Ball, 1921.— That we are still recovering from the effects of the war is recalled to our minds by the fact that since the Electrical Engineers' Ball of 1914—the eleventh of the series—that cheerful function has lain dormant. The New Year, however, is to see it restored to its normal place in the events of the season, and we have pleasure in giving below a list of the members of the Committee which is in charge of the arrangements. It will be held at the Hotel Cecil on Friday, February 4th.

The Electrical Engineers' Ball is like no other social event; it stands alone in providing an occasion on which the electrical fraternity foregathers in the spirit of comradeship and old acquaintance, determined to enjoy the passing moment to the full. It has invariably been triumphantly successful in that aim, and the organisers may be trusted to see to it that the twelfth ball will leave equally pleasant memories; it will be seen that the list embraces leading representatives of every branch of the electrical industry, and carries a weight which ensures a successful outcome.

Incidentally—though this forms no part of the purpose of the function—there is usually a surplus of revenue over expenditure, and it has become the custom to divide this between the Benevolent Fund of the Institution of Electrical Engineers and the Electrical Trades' Benevolent Institution.

General Committee.

H. Alabaster.
H. Allcock.
L. B. Atkinson.
O. H. Baldwin.
Geo. Balfour, M.P.
J. H. Bowden.
Sir T. O. Callender, K.B.E.
R. A. Chattock.
A. C. Cramb.
A. J. Cridge.
P. F. Crinks.
Sir Jas. Devonshire, K.B.E.
T. C. Elder.
H. W. Fairman.
Dr. S. Z. de Ferranti.
E. J. Fox.
E. Garcke.
T. E. Gatehouse.
Frank Gill.
Jas. Gray.
J. P. Gregory.
Col. C. C. Hardie, D.S.O.
F. B. O. Hawes.
C. W. Hill.
Hugo Hirst.
P. V. Hunter.
Sir J. Kemnal, K.B.E.
Major D. Kerr.
J. E. Kingsbury.
H. M. Leaf.
Col. F. A. Cortez Leigh.
Capt. W. S. Lonsdale.
A. R. McCullum.
J. J. McGregor.
H. T. S. MacKay.
P. V. McMahon.
W. L. Madgen.
W. Lee Matthews
E. W. Moss.
Lee Murray.
F. H. Nalder.
Sir Wm. Noble.
Col. W. A. J. O'Meara.
G. W. Partridge.
S. P. Pooley.
M. J. Railing.
P. F. Rowell.
W. Rutherford.
H. Scholey, C.B.E.
Sydney Sharp.
H. C. Siddeley.
A. M. Sillar.
Roger Smith.
Sir John Snell.
C. P. Sparks, C.B.E.
Geo. Sutton.
C. D. Talte.
G. M. C. Taylor.
J. Taylor.
J. M. G. Trezise.
Capt. R. J. Wallis-Jones.
Alf. H. Walton.
F. W. Willcox.
David Wilson.
C. H. Wordingham, C.B.E.

Executive Committee: O. H. Baldwin, E. J. Fox, C. W. Hill, J. E. Kingsbury, Capt. W. S. Lonsdale, P. V. McMahon, A. M. Sillar, C. H. Wordingham, C.B.E.

Hon. Secretaries: C. W. Hill, A. M. Sillar.

Hon. Treasurer: J. E. Kingsbury.

Woolwich Inquest.—At the adjourned inquest upon Maurice Pettett, who was killed by a piece of metal projected from the Woolwich power station when a turbine "raced away" and burst, several of the station employés gave evidence. William Cottle, an engine driver, who was injured by the explosion, said that he received instructions to start up the No. 4 set on the day of the accident. He did this, and the set was brought up to its normal speed of 3,000 R.P.M. The switchboard attendant was preparing to synchronise, and the driver was told to lower the speed of the machine, but as he was about to carry out the order the set began to race. He attempted to close the stop valve, but when the valve was about three parts closed the explosion occurred, and he was rendered unconscious. Mr. Swann, representing the manufacturers of the turbine, protested against reports, which had appeared in the Press, attributing the disaster to defects in construction. These premature statements were calculated to prejudice the firm's business, and he thought that another tribunal to inquire into the technical aspect of the case should be formed. The Coroner replied that he was not concerned with the cause of the accident, and it was not his intention to take any technicalities into consideration. William Stiff, the charge engineer, corroborated the driver's evidence, stating that when he saw it was impossible to shut the machine down he called to the driver to save himself. Frederick Elliott, station engineer, said the piece of metal which killed deceased had formed part of the alternator. A verdict of "Accidental Death" was returned by the jury.

A Club for Engineers in Birmingham.—For some time past an influential committee has been working in Birmingham, with the object of filling a long-felt want in the district, namely, a club where engineers can meet both for business and social purposes. Such progress has been made that an option has been exercised on premises in the heart of the city. Names of prospective members and promises to subscribe to capital are being received, a fact which is very

gratifying to the committee after the hard work which has been put in during the preliminary stages.

The project is receiving the hearty support of many of the industrial and professional leaders of the Midlands, and the list of officers includes as president, Sir Hallewell Rogers, J.P., M.P. (chairman of the B.S.A. Co., Ltd.), as vice-presidents, Sir Gilbert Claughton (chairman of the L. and N.W. Railway), Mr. Hugo Hirst (chairman and managing director of the General Electric Co.), Mr. R. A. Chattock (city electrical engineer, Birmingham), Mr. F. J. Dixon (chief engineer to the South Staffs. Waterworks Co.,) Mr. J. H. Lloyd, J.P. (director, Messrs. Stewarts & Lloyd), and Mr. Claud Tryon.

The chairman of the General Committee is Dr. Garrard; of the Finance and Buildings Committee, Mr. J. W. Madeley, J.P.; of the Rules and Propaganda Committee, Mr. R. A. Chattock; of the Membership Committee, Mr. W. F. Higgs, and the hon. secretary is Mr. J. Fearn, of the B.S.A. Co., Ltd.

We understand that there will be no entrance fees for the first 500 members. The annual subscription is to be five guineas, country members paying half that sum.

District Industrial Councils: Meeting of Employers' Side.—At the meeting which will be held early in January of the employers' sides of the various District Councils, we understand that the draft agreement between the employers and the trade unions of No. 10 (Greater London) Area will come up for consideration. The situation is at present that the draft agreement has been provisionally settled by the Greater London Council, and awaits the final approval of the National Council. Before the meeting at which the agreement will come up for final approval, the meeting of the employers' sides of the District Councils will take place, and it would appear that the action of the National Council will depend largely upon the consensus of opinion at that meeting. We understand that the feeling of the District Councils generally is that the National Council should postpone approval of the Greater London Area agreement until all the other Councils have had an opportunity of considering the principle involved. The agreement gives a guarantee to the employés in the Greater London Area that wages shall rise *pari passu* with the increased cost of living, and that wages shall similarly decrease down to the point where the cost of living is 150 per cent. above pre-war figures. If the Greater London agreement were approved by the National Council, it is obvious that a similar agreement would be presented to each of the District Councils, and that the case would be entirely prejudiced if any one Council had given unconditional assent to such agreement. Further, it is felt that the principle has even a national interest outside the electricity supply industry, since the unions involved are also largely interested in engineering works throughout the country. If such an agreement originates in the electricity supply industry, and especially in an important centre like London, it would seem likely that the trade unions would continue to use the electricity supply of London to force the demands in other parts of the country. The agreement, therefore, would seem to afford a possibility of greater uncertainty as regards strikes in London than ever, and so would not fulfil the purpose of the Greater London agreement as contained in the preamble, which was to ensure that the supply of electricity might be "carried on continuously without interruption." In the past successful claims have been put forward by the unions that the electricity supply industry should follow engineering awards; this was, of course, when the engineering industry was of crucial importance to the country during the war, and consequently the industry in which claims could not be resisted. Now, when the tables are somewhat turned, the policy apparently is to make the claims on the electricity supply industry and follow them up by claims on the engineering or other industries.

It seems to be a question whether the undertakings in Greater London fully appreciate the agreement to which they are committed; certainly it has given rise to considerable disquiet in undertakings in other parts of the country. There is a further important bearing on the country generally. If the Greater London agreement is to obtain throughout all industries, namely, that all workers are to be guaranteed for all future time that wages shall increase exactly in proportion to the cost of living, it is obviously a very important new consideration. The possible increased charge on the rates in the case of municipal undertakings and the higher prices for power supply will both have the same incidence, namely, in bearing hardly on manufacturing companies, which in turn will be still further thrust out of the world market, with a resulting increase of unemployment. The question is really not one of increase of wages, but whether the industry should be tied for all time under a legal agreement when the conditions of the future are quite unknown. These are some of the considerations which, we understand, are exercising the minds of many supply undertakings throughout the country which feel that they are being involved in the Greater London agreement.

Radium for Paris.—As a result of the visit of Mme. Curie, the Commission of the Paris Municipal Council is to recommend the purchase of 1 gramme of radium. Costing 400,000 fr. before the war, it will now, it is estimated, cost 1,000,000 fr. (roughly, £16,600).

Educational.—POLYTECHNIC, REGENT STREET, W.—A special course of six lectures on "Alternating-Current Wave Forms," by Mr. P. Kemp, M.I.E.E., will be held on Friday evenings, commencing January 14th; fee for the course 7s. 6d. For full particulars see our advertisement pages to-day.

The intimation that January 1st, 1921, will be the appointed day for the operation of the sub-sections of the Education Act, 1918, providing for the abolition of the half-time system and of the exemption from school of children under the age of 14, has, says *The Times*, been withdrawn. The Board of Education points out that at the time when the original intimation was given it was anticipated that the war would have terminated within the meaning of the Termination of the Present War (Definition) Act, 1918, before January 1st, 1921, which now appears improbable.

CONTINUED EDUCATION.—The handicap under which our schemes for educational reform are placed by the lack of funds to carry them into effect is well illustrated by a memorandum that was sent to the Prime Minister by the Federation of British Industries early this month. The Federation pointed out that school accommodation would be required for 1,200,000 additional students (age group 14-16), at a cost of £24,000,000; 30,000 more teachers would be required, costing £10,000,000 per annum, and the wage charge would be about £3,000,000 in the first year (representing loss in earning capacity). The total annual charge on the national resources would thus be about £15,000,000 if compulsory continued education up to the age of 16 years were established. In subsequent years the cost would be much greater as the Act came into full operation, and students aged 16-18 were provided for. The Federation therefore asked for the fullest consideration of the question from the financial point of view.

R.A.F. Electricians' Reunion.—A Committee has been formed, with Messrs. H. Lovelock and W. L. Turpie as joint secretaries, to complete arrangements for a reunion of the electrical section, E.R.S., R.A.F., France, which will take place in London, on Saturday, January 29th. All who served in this unit are requested to communicate with Mr. W. L. Turpie, 318, Cricklewood Lane, London, N.W. 2.

Appointments Vacant.—Cable jointer for the Leicester Corporation tramways and electricity department; electrical draughtsman (£550) for the Electrical Engineering Department, City and Guilds Engineering College; shift engineer for the Radcliffe Urban District Council Electricity Department. See our advertisement pages to-day.

Artificial Abrasives.—The manufacture of artificial abrasives—silicon carbide and corundum—in the electric furnace is described by C. J. Brockbank (*Journal of the Society of Chemical Industry, Transactions*, 1920, xxxix, 41-43). For silicon carbide or carborundum, electric furnaces of 1,000 to 3,000 H.P. are used; the yield per unit is somewhat larger in the largest furnace, but the product is somewhat inferior in quality to that made in the smallest furnace. The 1,000-H.P. furnace has an inside width of 5 or 6 ft., and a length of 20 ft. between the heads which carry the electrodes. These heads are 40 in. thick. Each terminal has two electrodes of graphite, 10 in. in diameter and 48 in. long. A resister core of 1,200 pounds of graphite powder is placed between the electrodes; it forms a layer 36 in. wide and 10 in. deep, and carries the current. The charge lies below, above, and on both sides of this core. A typical charge, using new materials, contains 1,500 lb. petroleum coke, 2,520 lb. white sand, 300 lb. sawdust, 40 lb. salt. The sawdust is used to make the mass porous, facilitate escape of the carbon monoxide formed in the reaction, and prevent formation of blowholes. The salt aids in the elimination, as chlorides, of impurities present in the sand and coke. The entire charge is not converted into carborundum; a portion merely serves as a heat-insulating blanket. This unused portion is added to the next charge, which has the following composition: Petroleum coke, 1,500 lb.; sand, 2,455 lb.; sawdust, 300 lb.; old mixture, 400 lb.; salt, 40 lb. The furnace is run at a voltage between 85 and 160, usually 85 and 100, for a period of 32 to 34 hours. Each pound of crystalline carborundum produced requires 5 KW.-hours of electrical energy. The crystalline product is removed from the furnace after cooling, is crushed, treated with sulphuric acid, and then with caustic soda to remove surface impurities, washed, dried, and screened. For abrasive wheels, it is mixed with a porcelain bond, and fired in a pottery kiln.

In the manufacture of artificial corundum (aluminium oxide) a typical furnace mixture is: Calcined bauxite ore, 1,750 lb.; coke, 100 lb.; iron borings, 350 lb. A layer of the mixture 1 ft. thick is placed on the carbon hearth, a train of graphite powder is laid from electrode to electrode, and the furnace is started. As soon as a molten path is formed, it carries the current, and more charge is added. The usual voltage is 100; from 4 to 5 tons of corundum are produced in a furnace with the expenditure of 18,000 KW.-hours of energy. Reduction is not carried too far, for traces (1 to 2 per cent.) of the oxides of iron, silicon, and titanium increase the toughness of the product. The iron oxide and silica present in the charge are reduced to metal alloy, and sink to the bottom of the furnace. The iron borings in the charge are used to keep the silicon content of this alloy below 15 per cent., and thereby facilitate its magnetic separation from the crushed carborundum.—*Journal of the Franklin Institute.*

Electrically-driven Battleships.—Mr. Daniels, Secretary of the U.S. Navy, has authorised the publication of a statement according to which three new types of ships for the U.S. Navy are now under construction. The first type comprises the six new battleships authorised in 1916, which will probably be the largest in the world. Next come the 3,000-ft., 2,000-ton submarines, which will have sufficient speed and cruising radius to enable them to accompany the Fleet as a part of it. The last of the trio is the latest type of aircraft carrier, the *Langley*, which vessel is the old electrically-driven collier *Jupiter*, refitted for her new *rôle*. With increased dimensions, displacement, and protection against attack, all the vessels will burn oil fuel, and will be electrically driven.

Sweden.—New Cables.—With reference to the note under this heading on page 785 of our issue of December 17th, we are informed that the contract, which includes loading coils and six intermediate repeater stations, was awarded to the International Western Electric, and not to the General Electric Co., as stated.

Service Notes.—Electrical artificers who are within three years of completing time for pension, or within three years of completing their first engagement and do not wish to re-engage, will not be required to requalify in the Torpedo School. Should such a rating, however, subsequently decide to re-engage, he will be required to requalify in his rating before being allowed to do so.

A new Navy Order states that the provisions of the monthly order No. 2,945, of 1918, in so far as they provide for one-half of the promotions to the rank of lieutenant or equivalent rank being made by selection from younger officers who have passed certain examinations, are not applicable to the telegraphist branch. In other respects, however, the provisions of the order in question will apply to this branch.—*The Times.*

Prevention of Railway Accidents.—Major A. Mount, R.E., reporting to the Ministry of Transport upon an accident at Preston (L. & Y. Railway) on September 25th which resulted in the receipt of injuries by 12 passengers, says: "It is unlikely that the accident would have happened had track circuits existed. The case is a good example of the value of the protection they afford. The company had . . . decided to install them here as part of an extensive programme of this type of work on the system. Difficulty, however, in obtaining material had delayed this work, as it has elsewhere. The installation had been completed when the inquiry was held."

INSTITUTION NOTES.

Diesel Engine Users' Association.—At the December meeting of the Association, Mr. C. O. Milton, A.M.I.E.E., electrical engineer to the Borough of Maidenhead, was elected President for the ensuing year, and Mr. Percy Still, M.I.E.E., M.I Pet.Tech, chief engineer to the Chelsea Electricity Supply Co., Ltd., was re-elected hon. secretary. Messrs. Napier Prentice, M.I.E.E., and A. E. Farrow, A.M.I.E.E., were elected members of the general committee in place of the two members who retired. The members of the Standing Committee on Insurance were all re-elected. The hon. secretary made his annual statement, showing that the Association has further increased its membership. The Association was hopeful that the I.E.E. Council would give permission to allow the meetings to be held in its building. The great majority of the members were at a considerable distance from the centre where meetings were held, scattered not only throughout this country, but in the British Dominions and foreign countries. The right to attend meetings was not considered the main advantage of membership, but the practical information circulated by the Association was appreciated and found helpful. The hon. secretary also made reference to the fact that he was frequently receiving inquiries for suitable men for appointments as chief engineers, assistant engineers and superintendents for installations having Diesel engine plant, or for fitters and drivers, &c.; he suggested that members would do well to refer to him any suitable applicants for such appointments.

Edinburgh Electrical Society.—Mr. James Walker's paper on "Electricity in the Factory" was delivered to the Society on December 17th. Mr. Walker dealt with the lay-out and equipment of an A.C. factory plant, and illustrated his remarks with a large number of lantern slides. Methods and devices for the orderly arrangement of motor control gear were given in some detail, and experiences in dealing with breakdowns were described. At the first meeting in the New Year, Mr. W. F. Mitchell, A.M.I.E.E. (late Mains Department, Edinburgh Corporation), will read a paper entitled "Some Notes on Cables."

Institution of Electrical Engineers (East Midland Sub-Centre).—On January 4th a meeting will be held at the College, Loughborough, when Colonel Newton, D.S.O., will give a lecture on "The Experiences of a State-Controlled Engineer," illustrated by lantern slides.

Birmingham Wireless Society.—A paper, entitled "The Manufacture of Thermionic Valves," was read on December 16th, by Mr. E. S. B. Staines, of the Edison Swan Electric Co., Ltd., before the Society at the Midland Institute. The author dealt very fully with the subject, and at the conclusion of the paper great attention was attracted by a comprehensive exhibit of valves and parts in various stages of manufacture.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

It is with interest we note that Mr. John Ames, general secretary of the Industrial League and Council, has been appointed a member of the Commercial Panel of the Appointments Department of the Ministry of Labour.

Mr. C. J. Jewell, M.I.E.E., has resigned his position as engineer to the Yorkshire West Riding Electric Tramways Co., Ltd., and has been appointed general manager to the Norwich Electric Tramway Co., Ltd., commencing in his new appointment on January 3rd, 1921.

Councillor R. J. Wilson has been re-elected chairman of the Sunderland Corporation Electricity Committee, and Councillor T. Speeding, vice-chairman.

Messrs. Kincaid, Waller, Manville & Dawson, consulting engineers, have taken into partnership Mr. A. E. Jackson, M.I.E.E., and Mr. H. G. Simmonds, who have been intimately associated with the firm as principal assistants for many years past. The address of the firm is now St. Stephens House, Victoria Embankment, S.W. 1, the Government having reinstated them in their former offices, which were commandeered during the war.

Mr. T. Birkett, Superintendent of Telegraphs, G.P.O., Edinburgh, has retired after 46 years' service. On Friday, last week, he was presented with a gold watch from the controlling officers and staff, and Mrs. Birkett received a gold brooch. Mr. Geo. Dawkes, Controller of Telegraphs, made the presentation.

Mr. A. G. Beaver has joined the board of the Sun Electrical Co., Ltd., as managing director.

Sir Adam Beck, of Ontario, Canada, arrived in London a week ago on a private visit.

Mr. A. E. Grocott, of Marconi's Wireless Telegraph Co. (Trans-Oceanic Section), has been appointed chief telegraph, telephone and radio-telegraph engineer to the Siamese Government.

Wills.—Sir Chas. Petrie, director of the Singapore Electric Tramways, Ltd., left £58,067.

Sir D. W. Owen, director of the Urban Electric Supply Co., Ltd., and the Cornwall Electric Power Co., Ltd., left £22,745.

NEW COMPANIES REGISTERED.

Superlamp, Ltd. (172,067).—Private company. Registered December 16th. Capital, £1,000 in £1 shares. To carry on the business of dealers in, exporters and importers and manufacturers of electrical, gas, oil, and lighting goods and accessories, &c. The subscribers (each with 250 shares) are: C. Orgel, 111, Great Eastern Street, E.C. 2, electrical accessories dealer; Mrs. S. Orgel, 125, Queens Road, N. 4. The subscribers are to appoint the first directors. Secretary: S. Orgel. Registered office: 111, Great Eastern Street, E.C. 2.

E. & C. Gates, Ltd. (172,187).—Private company. Registered December 22nd. Capital, £3,000 in £1 shares (2,700 10 per cent. cumulative preference and 300 ordinary). To take over the business of an electrical engineer and electrician carried on by C. Gates as "E. & C. Gates," at Arcade Street, Norwich. The first directors are: M. C. Warren (chairman), Swardeston, Norwich (director of Claxton & Warren, Ltd., and the Norwich Improved Pulling Co., Ltd.); C. Gates, 80, Mornington Road, Norwich. Qualification: 200 shares. Registered office: Arcade Street, Norwich.

British Industries Fair (Birmingham), Incorporated (172,127).—Registered December 20th as a company limited by guarantee, without share capital. The company is not formed for purpose of profit, and the word "limited" is omitted from the title by licence of the Board of Trade. To organise and promote the British Industries Fair, Birmingham. The subscribers, numbering 68 or more gentlemen (all in Birmingham and district), are named in the Articles of Association as first members, subject to their written consent being received. The management is vested in a Council, to be appointed by a majority of the members. Solicitor: F. T. Edge, 5, Waterloo Street, Birmingham. Registered office: 95, New Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Oriental Telephone & Electric Co., Ltd.—Satisfaction to the extent of £7,900, on December 7th, 1920, of trust deed dated June 28th, 1905, and deed of acknowledgement dated June 12th, 1907, securing £200,000 debenture stock.

South Metropolitan Electric Light & Power Co., Ltd. (47,875c).—Return dated March 10th (filed December 1st, 1920). Capital, £500,000 in £1 shares (250,000 ordinary, 150,000 7 per cent. cumulative first preference, and 100,000 6 per cent. cumulative second preference), 150,000 ordinary, 142,968 first preference, and 96,366 second preference shares taken up; £381,466 paid; £7,868 considered as paid. Mortgages and charges, £374,090 paid.

Henry Bisseker, Ltd.—Satisfaction to the extent of £1,000 on September 7th, 1920, of debentures dated October 31st, 1919, securing £7,700.

Wey Engineering Co., Ltd.—Issue on December 14th, 1920, of £3,500 debentures, part of a series already registered.

Hindhead & District Electric Light Co., Ltd.—Issue on December 7th, 1920, of £100 debentures, part of a series already registered.

Bolton Welding Co., Ltd.—Mortgage dated November 30th, 1920, to secure £350, charged on 42, Howard Street, Bolton, and stables and outbuildings adjoining. Holder: T. Y. Ritson, 7, Wood Street, Bolton.

County of London Electric Supply Co., Ltd.—Charge on certain land at Barking dated December 1st, 1920, to secure £30,000. Holders: North British & Mercantile Insurance Co., Ltd.

Creed & Co., Ltd.—Debentures dated December 10th, 1920, to secure £35,000 charged on certain freehold land and buildings in Croydon subject as to 1, 3, and 5, Addiscombe Road, to a mortgage for £3,000, and the company's undertaking and property, present and future, including uncalled capital. Holders: F. W. Ellis and H. J. Wells, 2, Princes Street, E.C., trustees of National Provincial and Union Bank of England, Ltd.

Siemens Brothers Dynamo Works, Ltd.—Satisfaction to the extent of £490,000, on December 14th, 1920, dated February 1st, 1918, securing £690,000.

General Brass Fittings Co., Ltd.—Particulars of £10,000 debentures authorised December 6th, 1920; whole amount issued; charged on the company's undertaking and property, present and future.

CITY NOTES.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The fifty-seventh ordinary general meeting of this company was held on Tuesday, December 21st, at the offices, 106, Cannon Street, Major Leonard Darwin in the chair. In proposing the adoption of the report, the chairman said, in dealing with the cash position of the company, he wished to point out that on the liability side of the balance sheet was an item which included "Loan from Bankers," the appearance of which should occasion little surprise, notwithstanding the fact that new capital amounting to £315,726 6s. 3d. was introduced during the year under review. By reason of the increased cost of labour and of nearly every kind of material, all business concerns now required at least three times the amount of liquid capital required in pre-war days. Such had been their experience in England, and also in their French factory, and the difficulty had been aggravated by most persistent and peremptory demands by the Inland Revenue for payment of excess profits duty. In respect of that tax over £400,000 had been paid by the company since the beginning of the war, and of that amount £180,000 had been paid within the last twelve months; whilst taking income tax also into account, the total sum paid amounted to over half a million sterling. The board deemed it impolitic at the time to attempt to increase the paid-up capital by more than £250,000, preferring to meet further requirements by means of temporary loans from the bankers. Whilst thus indebted, and until more favourable conditions existed whereby they could show a more liquid state of their assets, the directors were convinced that the only policy which could be adopted was that of deferring their recommendation of a further distribution to the ordinary shareholders, a policy they believed to be in the best interest of all concerned. The turnover at Silvertown for the year showed a slight increase as compared with that of the previous year, considerable changes having, however, taken place in the relative production of the different departments. Owing to the practical stoppage of all aeroplane tire and wheel work, and also to the slackness of trade in motor and cycle tires during the latter part of the year, the output of the tire section had materially diminished, both in value and quantity. As a set-off against this, the output of their general business had gone up, with the result of a slight increase in the total turnover. As regarded the future, the value of orders on the books for general goods was approximately the same as last year, but the orders for motor tires were very much down owing to the recent slump in that market. Although they had been free from strikes on the part of their own workers, the strikes in other trades had seriously affected the progress of work in their factory; and they had been obliged to shut down the greater part of the works early in the financial year owing to the railway strike. A very serious interference with their trade was also caused by the moulders' strike, which not only greatly delayed the completion of the work being executed in their own engineering shops, but also caused long delays in the delivery of machinery and appliances which were on order from other firms. The cost of production being of such great importance, he must call attention to the way in which it was affected by the existing heavy taxation on industry. He had already pointed out that they were not getting from the worker such an increase in output per hour as would counterbalance the effect of the reduction in working hours, and the efforts of the management to compensate for the consequent reduction in daily output, by the introduction of new machinery specially designed to increase the output per hour, had been greatly hindered by the want of money which, instead of being applied to that most necessary purpose, had had to be paid over to the Government for excess profits duty, income tax, and local taxation. The Persan works did good business during the year in all directions, including tires, whilst working under many difficulties arising chiefly from lack of fuel, strikes, and the general dislocation of industry. At their Burton works great and unavoidable delays took place in changing over from war to peacetime conditions; but they commenced turning out new lines of goods in the early part of the year, and the rate of increase was encouraging. The foreign branches on balance showed approximately the same profit as last year. During the war, almost every single British aeroplane wheel and tire was made by them. After the war the demand for those goods fell off very greatly, and they had to revert to a great extent to lines of trade abandoned in favour of war work. There they found themselves at a disadvantage, because their opponents, less busy with war work than themselves, had been able in large measure to fill the place they had formerly occupied in those civil lines of trade. Then again, with the approval of the English Government, they picked up and relaid German cables for the French Government, who marked their appreciation of the work done by the award of the Legion of Honour to their managing director. Their steamer, when employed on that work, was sunk without warning by a German submarine. For all that they had received but bare thanks and no compensation whatever from the English Government. The chairman felt complete confidence as regarded the ultimate future of the company. They had received a few letters from shareholders pointing out the hardship that would be inflicted upon them by the withholding of dividends. He and the board felt the deepest sympathy with those shareholders in their unfortunate position, but it was no fault of the directors. The way to face a position of the sort they were now confronted with was calmly and without panic, and that was what they intended to do. With that policy before them he had no doubt that the cash position would slowly and steadily improve. The report was adopted.

Vickers, Ltd.

The directors' annual report states that the book value of the land, buildings, machinery, &c., after taking additions into account and allowing for depreciation, has risen from £5,724,486 at December 31st, 1915, to £7,314,094 at the end of 1919. On the other side, the reserves have increased from £2,064,261 to £6,669,159. The £200,000 shown as "Reserve for Works Extensions" in the 1915 balance sheet has been merged in "General Reserve," bringing that account to £1,200,000. Interests in subsidiary and connected companies have risen from £5,448,734 to £17,236,516. Practically the whole of this large increase is due to the purchase authorised at the general meeting held on March 24th, 1919, of the shares of the Metropolitan Carriage, Wagon and Finance Co., Ltd., which included a controlling share in the British Westinghouse Electrical and Manufacturing Co., Ltd., with its subsidiaries, and interests in other electrical concerns. The name of the British Westinghouse Company was changed in August, 1919, to The Metropolitan-Vickers Electrical Co., Ltd., by agreement with the American Westinghouse Co. The second and third mortgage debentures of which the outstanding balances at December 31st, 1915, amounted together to £1,058,200 were reduced by annual redemptions and have been finally paid off. The 4 per cent. first mortgage debenture stock of £1,250,000 redeemable in 1937 alone remains outstanding. The amount distributed in dividends in respect of the four years ending December 31st, 1919, reached the figure of £3,967,112. After payment of these dividends, and providing for all Government taxation as nearly as can be estimated to the end of the year 1919, and after adding £319,749 16s. brought forward from 1915, the amount to be carried forward from 1919 to the credit of the current year is £846,363 14s. 2d. A special note circulated with the report gives a summary of the work done by the company during the war.

French Companies.

The Compagnie Générale Electrique (*Nancy*) reports net profits amounting to 1,350,000 fr. for 1919-20, and a dividend at the rate of 8 per cent., or 40 fr. per share.

The Société Electricité de Paris reports net profits of 2,543,000 fr. for 1919-20, as compared with 2,548,000 fr. in the preceding year. The directors recommend a dividend at the rate of 20 fr. per share, as in 1918-19.

The Société de Constructions Electriques, of Lyons, reports gross profits and balance forward amounting to 254,000 fr., permitting of the payment of a dividend at the rate of 11 fr. per old share on capital of 1,000,000 fr., and 1.50 fr. per share on the new shares for 1,000,000 fr.

The Compagnie Industrielle des Téléphones reports net profits and balance forward amounting to 4,119,000 fr. for 1919-20, as contrasted with 5,005,000 fr. in the previous year. It is intended to pay a dividend at the rate of 35 fr. per share, as in 1918-19.

The Société des Accumulateurs Electriques (*late A. Dinin*) reports that the production of batteries for various purposes was developed during 1919-20, particularly for telephony, railways, wireless telegraphy, &c. At present the company is devoting its efforts to the manufacture of stationary batteries, and expects to occupy a prominent position in this respect both in the French and foreign markets. After making provision for depreciation, the accounts show net profits of 998,000 fr., permitting the payment of a dividend at the rate of 20 fr. gross per share, as compared with 36 fr. for the 18 months which formed the preceding financial year.

The ordinary meeting of the *Constructions Electriques* (*Nancy*) has approved the report of the management, and fixed the dividend at 15 per cent. It has also authorised the raising of the capital from 2,000,000 to 4,000,000 fr.

The Société des Forces Motrices de la Vienne has just issued 6 per cent. bonds to the amount of 10,000,000 fr. The Isle Jourdain dam and station on the Vienne will shortly be completed, and will probably enter on working at the end of the year. The available power anticipated is 9,000 H.P., and the yearly output 25,000,000 kilowatt-hours.

The meeting of October 20th of *The Forces Motrices du Haut Rhen* voted a dividend of 62 fr. 50 c. per share, the profits realised totalling 2,110,850 fr. The report states that during the year the kilowatt-hours sold were 57,417,517, against 41,119,319 in the foregoing year.

The Compagnie Méridionale d'Eclairage et de Force is about to raise its capital from 500,000 to 1,000,000 fr.

A dividend of 6 per cent. has been voted by the *Société d'Electricité pour la Lumière et la Force*, after having approved the accounts of the last working year.

The shareholders' meeting of *Le Fil Dynamo*, held at Lyons on November 6th, passed the accounts and approved of the distribution of a dividend of 8 fr. per share, and of 7 fr. 375 c. on the founders' shares. An extraordinary meeting approved of the increase of the capital to 1,000,000 fr.

The Société Centrale d'Enterprises has decided to raise its capital from 1,000,000 to 6,000,000 fr.

The meeting of *The Appareillage Electrique Genteur*, on November 15th, approved the accounts for the year and voted the distribution of a dividend of 10 per cent.

The capital of *The Electrique de Vyrebagne* has been raised to 3,000,000 fr. by the issue of 4,000 500-fr. shares. The management has been authorised to increase the capital by one or more operations to 10,000,000 fr.

The profits of the last working year of *The Compagnie Générale Electrique de Nancy* total 1,350,543 fr., out of which a dividend of 8 per cent. has been declared. This important company has built and is building vast extensions to its electrical and electro-mechanical establishment, it possesses electro-chemical works, a factory for electric accumulators, and exploits the American Willard patent for batteries for starting and lighting motor vehicles: it has started a foundry to supply its own requirements of copper and brass. In addition, it has shares in seven great companies specialising in diverse branches of the electric industry.

German Companies.

The A.E.G. Unternehmungen A.G., of Berlin, whose assets consist of credits and shares held in the Berlin Electricity Works Co., report net profits of 652,000 marks for 1919-20, as compared with 702,000 marks in the previous year. It is intended to pay a dividend at the rate of 6 per cent. on the share capital of 10,000,000 marks, being the same rate as in 1918-19.

The Rheinische Elektrizitats A.G., of Mannheim, after making provision for depreciation, reports net profits of 2,031,000 marks for 1919-20, as compared with 1,000,000 marks in the preceding year. It is proposed to pay a dividend at the rate of 10 per cent., as against 7 per cent. in 1918-19, and to issue 18,000,000 marks in 6 per cent. preference shares with single voting powers and 2,000,000 marks in 6 per cent. preference shares each having 20 votes.

The directors of the *Telephon Fabrik vorm. Berliner A.G., of Berlin*, who recommend a dividend at the rate of 15 per cent. for 1919-20, as compared with 6 per cent. in the preceding year, propose to increase the share capital by 5,000,000 to 17,500,000 marks. At the same time, a further augmentation, aiming at the prevention of the majority control of the undertaking passing into foreign hands, of 2,500,000 marks is in contemplation in the form of the issue of "B" shares each carrying six votes. These shares will first participate in the profits after the ordinary shares have received 5 per cent.; they will then have 5 per cent., while the profit balance remaining will be divided between the two classes of shares according to their nominal value.

Norwegian Nitrate Companies.

The report for 1919-20 of the *Norsk Hydro, Elektriske Kvaelstof A.S., of Notodden*, states that operations at the works proceeded satisfactorily, and the sales of the company's products continued regularly. Prices steadily declined in the first half of 1919, but in the past year they experienced a fresh increase, particularly sodium nitrate and ammonium nitrate. Constructional work at the A.S. Tyinfaldene (Tyin Falls) was resumed in July after a strike extending over a year. In the case of the company's other interests, it is mentioned that the A.S. Rjukanfos, which has 290,000 H.P. now at disposal, has declared a dividend at the rate of 20 per cent. and an extra dividend of 13.5 per cent.; and the Norsk Transport A.S. has been able to distribute a rate of 15 per cent. The accounts of the Norsk Hydro show a surplus of 24,855,000 kr., and it has been decided to pay a dividend at the rate of 15 per cent. for 1919-20, and carry forward the sum of 16,384,000 kr.

The Société Norvégienne de l'Azote et de Forces Hydro Electriques, whose works are situated at Svaelgfos-Notodden, reports net profits of 18,826,000 kr. for 1918-19, and a dividend at the rate of 12 per cent., leaving 2,614,000 kr. to be carried forward.

Drake & Gorham, Ltd.—The directors announce that payment of the dividend of 10 per cent. per annum on the ordinary shares for the year ended June 30th, 1920, which was postponed at the annual meeting, will be made forthwith.

Stock Exchange Notice.—The undermentioned security has been ordered to be officially quoted:—

Calgary Power Co., Ltd.—500 shares of 100 dollars each.

Coventry Chain Co., Ltd.—Final dividend of 7 per cent., making 12½ per cent. for the year, less tax; and bonus of 2½ per cent. on the ordinary shares, less tax.

Urban Electric Supply Co., Ltd.—The directors have notified the shareholders that the Ministry of Transport has decided to allow an increase on charges in all the company's undertakings. These increased rates are, however, stated to be under existing conditions insufficient to give an adequate return on capital and afford no provision for making good the deficient revenues of the past few years. Unless, therefore, the Ministry gives a more generous recognition to the facts of the situation, it is probable that the whole of the company's resources will for some time be required to meet pressing current needs. Although the position has been materially improved by the increased rates sanctioned, it is still far from satisfactory.

South African Carbide & By-Products Co., Ltd.—The report for the year ended September 30th, 1920, states that it is anticipated that the carbide factory and the power station will be in full working order in six months' time. Considerable progress has been made with the producer and low temperature sections of the plant, and a portion of this plant will be in operation shortly after the carbide section. One of the directors who has recently returned from South Africa, after inspecting the works, is fully satisfied with the progress made.

Reduction of Capital.—*Julius Sax & Co., Ltd., and reduced.*—An order confirming the reduction of capital of the above company from £18,000 to £3,600 was made by Mr. Justice Lawrence in the High Court (Chancery Division) on November 30th.

Victoria Falls & Transvaal Power Co., Ltd.—The net earnings, including those of the Rand Mines Power Supply Co., Ltd., for the quarter ended September 30th, 1920, amounted to £203,436 before providing for taxation in South Africa and the United Kingdom.

North Wales Power & Traction Co., Ltd.—Accounts for the year ended June 30th, 1920, show a balance at profit and loss account of £413.

W. & T. Avery, Ltd.—Interim dividend of 5 per cent., less tax, on the ordinary shares.

Bell Telephone Co. of Canada.—Dividend of 2 per cent., less tax, on capital stock.

STOCKS AND SHARES.

Tuesday Evening.

FOR this much the electricity markets can be thankful to Nineteen Twenty—that some of the stocks and shares have achieved improvement. Which is more than can be said with regard to most of the other markets round the Stock Exchange. The year has been an unfortunate one for investors. Millions of pounds of new capital poured out in the first few weeks. There was a glut of new issues. Many received cordial welcome from the public. Surprisingly little rubbish appeared. As was natural, the ratio of temptation to the investor had to be increased with every week. The obvious result led to depreciation of existing prices; to the introduction of a new standard of yield demanded from investments; to a more exacting discrimination in the choice of securities.

Money difficulties started soon after the Budget had been opened. In fact, from the beginning of the year, the factor of banking facilities has played a prominent, often a desolating, part in the piece. The Government has wanted money for its extravagance, and this has weighed upon industry. The aftermath of war—declining trade, chaotic foreign exchanges, unemployment, and such like—bears heavily upon the prices of stocks and shares. Companies are passing, or postponing dividends, and the appeal for fresh capital has to be backed by very strong security for it to attain even a moderate success to-day.

This year we take the prices of the past two years, 1919 and 1920, for purposes of comparison. (The figures for 1918 and 1919 were given in our issue of January 2nd, 1920, p. 23.) Twelve months ago, every share in the list of electricity supply shares, Metropolitans alone excepted, showed falls on the year. This time, however, a quartette of advances stand out with pleasant prominence. The City of London Company has split its £10 shares into the more readily-negotiable £1 denomination. Appended to the electricity supply list is a small group of Underground Railway issues, in which it will be noticed that the falls are relatively heavy:—

HOME ELECTRICITY COMPANIES.

Stocks or Shares.	Dec. 31st, 1919.	Dec. 28th, 1920.	Rise or fall.	Stocks or Shares.	Dec. 31st, 1919.	Dec. 28th, 1920.	Rise or fall.
Brompton & Ken.	5⅞	6	+ ⅛	London	1⅛	⅞	— ⅛
Charing Cross ..	2⅛	8⅜	+ ⅛	Metropolitan ..	3	2⅝	— ⅜
Chelsea	8	8¼	+ ¼	St. James' ..	6	6½	+ ½
City of London ..	12	1⅛	—1/8	South London ..	2⅛	2⅛	— 1/8
County of London	9⅛	7⅛	— 1⅛	Westminster ..	5⅛	4⅛	— 1
Kensington ..	4⅛	3⅝	— ½				

HOME RAILS.

Cen. Ldn. Ass. Ord.	58½	43½	—15	Underground Ord.	2½	1⅛	— ⅜
Metropolitan ..	25½	20	— 5½	,, (A) ..	6/6	5/-	—1/6
District	21	15½	— 5½	,, Inc. ..	81	60½	—20½

In the cable market, the Eastern group increased its capital by the issue of new stocks and shares at par. This afforded substantial bonuses to the proprietors. Allowing for the melon-cutting, the quotations of the companies concerned are decidedly higher on the year. The new stocks stand at big premiums.

Apart from these, however, the various prices are lower. Marconi's have undergone violent fluctuations since the re-arrangement of the capital earlier in the year. Mexicans make a mixed showing amongst foreign tramway and traction descriptions :—

TELEGRAPHS AND TELEPHONES.

Ang.-Amer. Pref.	9⅛	7⅝	– 1⅝	Indo-European ..	42½	20	–18½
Cuba Submarine	10⅛	7	– 3⅛	Marconi	4⅛	2⅛	—
E. Extension ..	16⅛	14⅞	—	United R. Plate..	7⅞	5¾	– 1⅞
E. Telegraph ..	163⅛	153⅛	—	W. India & Pan.	1¼	⅛	– 1/16
Globe Tel. Ord. ..	16⅛	14⅞	—	Western Teleg. ..	17½	14⅞	—
Great Northern ..	23⅛	20⅛	– 3				

FOREIGN TRACTION, &c.

A. Arg., 1st Prf. ..	38	3	– ⅛	Mex. Trams. 1st	42⅛	38	– 4⅛
Brazil Traction..	60⅛	37	–23⅛	Mex. Light Com.	17	16	– 1
B. Col. Elec. Prf.	61⅛	56	– 5⅛	do. Pref. ..	25	25⅛	+ ⅛
do. Preferred..	54⅛	55⅛	+ 1	do. 1st	52⅛	60⅛	+ 8

The manufacturing section has fared badly this year, as half-a-score of examples will illustrate :—

MANUFACTURING.

Babcock & Wilcox	9⅞	2⅛	– 1⅛	Elec. Construct...	1⅛	⅛	– ⅛
Brit. Aluminium	1⅛	⅛	– ⅛	Gen. Electric ..	2	1⅛	– ⅛
B. West. Pref. ..	2⅛	1⅛	– ⅛	Henleys	2⅛	1⅛	– ⅛
Callenders ..	8⅛	1⅛	– 5/6	India-Rubber ..	18⅛	⅛	– 19/-
Castner-Kellner..	3⅛	⅜	– ⅛	Telegraph Con...	26⅛	21	– 5⅛

Edison's have come down from 23s. 9d. to 10s. British Westinghouse Preference have been changed into Metropolitan-Vickers Preference. Dividends on a fair number of Industrial Preference shares have been raised. But the labour disquietude, coming to a head in the coal strike, seriously impeded the wheels of trade. With this on the one hand, and financial stringency on the other, Stock Exchange prices could not hope to make a stand. Convention calls for optimism at the opening of a New Year, and it may be diffidently hoped that no one will quarrel with the expression of a hearty wish for a more Prosperous New Year.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1918.	Dividend 1919.	Price Dec. 28, 1920.	Rise or fall.	Yield p.c.
Brompton Ordinary	8	12	6	—	£10 0 0
Charing Cross Ordinary	4	7	5⅜	—	10 7 4
do. do. do. 4½ Pref. ..	4½	4½	2⅛	—	8 3 8
Chelsea..	3	4	2½	—	6 8 0
City of London	8	10	1⅛	—	8 17 10
do. do. 6 per cent. Pref. ..	6	6	17/6	—	6 17 2
County of London	7	8	7⅛	—	10 13 4
do. do. 6 per cent. Pref.	6	6	6	—	7 10 0
Kensington Ordinary	6	7	5⅛	—	9 0 6
London Electric	Nil	2½	⅜	—	10 0 0
do. do. 6 per cent. Pref...	6	6	2⅛	—	10 18 2
Metropolitan..	5	6	3⅜	—	11 8 8
do. 4½ per cent. Pref. ..	4½	4½	2¼	—	8 0 0
St. James' and Pall Mall	10	12	6⅛	—	9 12 0
South London	5	6	2⅝	—	9 12 0
South Metropolitan Pref.	7	7	10/6	—	8 12 8
Westminster Ordinary	8	10	4⅛	—	10 10 6

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	6	6	75½	–1	7 19 0
do. Def.	33,6	1½	16⅜	– ⅛	9 12 6
Chile Telephone	8	6	6½	—	*5 9 1
Cuba Sub. Ord.	7	7	7	—	*10 0 0
Eastern Extension	8	10	14⅛	– ⅛	*6 15 7
Eastern Tel. Ord.	8	10	15⅝	—	*6 11 4
Globe Tel. and T. Ord.	8	10	14⅛	—	*6 15 7
do. do. Pref.	6	6	8½	—	7 1 2
Great Northern Tel.	22	22	20⅝	—	10 14 8
Indo-European	18	10	30	—	6 6 8
Marconi	25	25	2⅛	+ ⅛	— —
Oriental Telephone Ord.	10	12	2⅞	– ⅛	*5 4 0
United R. Plate Tel.	8	8	5⅞	– ⅛	*6 16 4
West India and Panama	1/8	Nil	⅛	—	Nil
Western Telegraph..	8	10	14½	—	*6 15 7

HOME RAILS.

Central London Ord. Assented ..	4	4	43½	—	9 4 6
Metropolitan	1	1½	20	—	6 5 0
do. District	Nil	Nil	15½	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅞	– ⅛	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income ..	5	4	60½	–1	—

FOREIGN TRAMS, &c.

Anglo-Arg. Trams, First Pref. ..	Nil	5½	8	—	9 2 4
do. do. 2nd Pref. ..	Nil	Nil	3½	—	Nil
do. do. 5 % Deb. ..	5	5	54½	—	9 6 6
Brazil Tractions	Nil	Nil	37	– ½	Nil
British Columbia Elec. Rly. Pfcs.	5	5	56	– 2	8 18 4
do. do. Preferred	2½	5	55½	—	*6 6 2
do. do. Deferred	Nil	8	82½	–1	*6 10 10
do. do. Deb. ..	4½	4½	66½	—	7 10 5
Mexico Trams 5 per cent. Bonds..	Nil	Nil	38	–2	Nil
do. 6 per cent. Bonds..	Nil	Nil	27½	–4	Nil
Mexican Light Common	Nil	Nil	16	—	Nil
do. Pref.	Nil	Nil	25⅛	—	Nil
do. 1st Bonds	Nil	Nil	60½	+4	Nil

MANUFACTURING COMPANIES.

Babcock & Wilcox	15	15	9⅛	—	7 1 2
British Aluminium Ord.	10	10	⅜	– 6d.	11 8 6
British Insulated Ord.	12½	15	1⅛	– ½	10 18 2
Callenders	25	15	1⅛	—	10 18 2
.. 6½ Pref.	6½	6½	13/9	—	6 18 8
Castner-Kellner	20	17	3	—	5 12 4
Crompton Ord.	10	10	16/6	—	12 2 6
Edison-Swan	10	10	10/-	–4/6	—
do. do. 5 per cent. Deb. ..	5	5	72	—	6 19 0
Electric Construction	10	10	16/6	—	11 8 6
Gen. Elec. Pref.	6½	6½	18/-	—	7 4 5
do. Ord.	10	10	1⅛	– ⅛	*8 8 5
Henley	25	15	1⅛	—	9 4 8
do. 4½ Pref..	4½	4½	6¼	—	7 4 0
India-Rubber..	10	10	⅞	– ⅛	—
Met.-Vickers Pref.	—	8	11½	—	9 9 4
Siemens Ord....	10	10	1⅞	—	*9 8 9
Telegraph Con.	20	20	31	—	*5 14 9

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, December 28th.

CHEMICALS, &c.	Latest Price,	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per lb.	1/10	...
a Ammoniac Sal ... ... per ton	£110	...
a Ammonia, Muriate (large crystal) "	£92	...
a Bisulphide of Carbon ... ... "	...	...
a Borax ... ... "	£41	...
a Copper Sulphate ... ... "	£43	...
a Potash, Chlorate ... ... per lb.	1/-	...
a " Perchlorate ... ... "	1/8	...
a Shellac ... ... per cwt.	£23	...
a Sulphate of Magnesia ... ... per ton	£18	...
a Sulphur, Sublimed Flowers ... "	£34	...
a " Lump ... ... "	£20	...
a Soda, Chlorate ... ... per lb.	6d.	...
a " Crystals ... ... per ton	£12	...
a Sodium Bichromate, casks ... per lb.	...	...
METALS, &c.		
p Babbitt's Metal Ingots ... ... per ton	£95 to £300	...
c Brass (rolled metal 9" to 19" basis) per lb.	1/1½	½d. dec.
c " Tubes (solid drawn)... "	1/2½ to 1/4	½d. dec.
c " Wire, basis ... ... "	1/1½	½d. dec.
c Copper Tubes (solid drawn) "	1/8	½d. dec.
c " Bars (best selected) ... per ton	£122	£7 dec.
c " Sheet ... ... "	£122	£7 dec.
c " Rod ... ... "	£122	£7 dec.
d " (Electrolytic) Bars ... "	£84	£7 dec.
d " " Sheets ... "	£143	...
d " " Wire Rods.. "	£100	£7 dec.
d " " H.C. Wire .. per lb.	1/0½	½d. dec.
f Ebonite Rod ... ... "	8/6	...
f " Sheet ... ... "	8/-	...
n German Silver Wire ... ... "	2/-	...
h Gutta-percha, fine ... ... "	14/- to 16/-	...
h India-rubber, Para fine ... ... "	1/3	...
i Iron Pig (Cleveland Warrants) ... per ton	Nom.	...
l " Wire, galv. No. 8, P.O. qual. "	£54	...
g Lead, English Pig ... ... "	£24 10	10/- dec.
g Mercury ... ... per bot.	£14 to £14 5	...
e Mica (in original cases) small ... per lb.	6d. to 4/6	...
e " " " medium .. "	5/- to 10/-	...
e " " " large ... "	12/6 to 25/- & up	...
p Phosphor Bronze, plain castings "	1/6 to 1/11	...
p " " rolled bars and rods "	2/5 to 2/8	...
p " " rolled strip & sheet "	2/5 to 2/9	...
d Silicium Bronze Wire ... ... per lb.	1/10	1d. dec.
r Steel, Magnet, in bars ... ... "	1/8	...
n Tin, Block (English) ... ... per ton	£196	£17 to £18 dec.
n " Wire, Nos. 1 to 16 ... ... per lb.	4/9	...
p White Anti-friction Metals ... per ton	£78 to £300	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons,
p
r W. F. Dennis & Co.

Dazzle Head Lights.—The Royal Automobile Club announces that its representatives have evolved a test by which the dazzle of vehicle head-lamps can be measured, and the results obtained from different lamps compared. The testing device is known as the "R.A.C. Standard Disk," which, when illuminated by the lamps, gives information on the effective width of illumination on the road, the effective range of the lamp, and its actual dazzling effect on the oncoming driver or pedestrian. It is hoped the device will constitute a standard method of determining the value of anti-dazzle lamps.

Improving Transport.—The *Morning Post* gives a short *résumé* of suggestions for dealing with the London traffic problem, made by Mr. W. Y. Lewis in a paper presented to the London Society. Mr. Lewis stated that "no tinkering with the present systems would do any good; the whole intermittent system must be swept away." One is tempted to wonder if the scrap value of the "underground" railways would compensate those financially interested. The report further states: "A continuous system dispensed with much of the delay and the high cost of present methods. Briefly, the idea proposed by the speaker, and known as the Adkins Lewis system, consists in the use of small cars, each accommodating four or five persons, and being operated so as to come together and slow down at stations, to allow passengers to step on and alight. The cars would never come to a dead stop, and between the stations they would be accelerated and spaced out."

There is yet another idea. This is "to erect the system about 20 ft. above the streets, or even have an installation over the roofs of offices and buildings. These elevated railways must not be confused with the cumbersome New York and Liverpool undertakings."

Is "over" synonymous with "upon"? If it is, offices would soon be "to let," and there would be a general "back to the land" movement on the part of city men. And why this system should be less "cumbersome" than the New York and Liverpool undertakings is difficult to comprehend.

GENERATING-STATION EXPEDIENTS IN WAR-TIME.

The operation and maintenance difficulties experienced by generating stations' staffs in this country during the war fade into insignificance when compared with those experienced by the staff of the Société "Force Electrique" at Baku. At the best, the Société could not hope for delivery against its orders in less than 18 months or so, and, as a matter of fact, goods ordered in 1915 are still undelivered owing to the revolution in October, 1916. It is to be hoped that no generating station in this country will ever be reduced to the expedients employed at Baku and described by Mr. F. Scoumanne, director of the S.F.E., in a recent issue of the *Bulletin de la Société Belge des Electriciens*. These expedients are, however, interesting as showing what liberties can be taken with large central station plant, and as examples of successful makeshifts, they may be useful to engineers in some outposts of the Empire.*

Had Russia been spared internal strife the position of the Baku stations would still have been sufficiently difficult, for the Caucasus was practically isolated from the rest of the world during the greater part of the war period. Until the end of 1916 there was fairly regular communication with Russia, but the only outlet to the world beyond was Archangel —icebound for half the year,—and connected with Moscow by a single line of railway. Although engaged in war work (the extraction of naphtha) the Baku stations had often to wait three or four months for transport permits. Apart from transport problems it was very difficult for such remote stations to place orders for supplies, especially in view of the fact that much of the plant was of German manufacture.

Comparatively small stocks of spares were held at the stations themselves, and there were no local sources of general engineering supplies, and no facilities for manufacturing them. Under such conditions unorthodox methods had to be adopted in practically every part of the plant.

Boilers.—The stock of boiler tubes was naturally insufficient to last through the war, but it was found possible to obtain some good tubes slightly too small in diameter and 60 cm. too short. These tubes, 3¼ in. in diameter, were lengthened by welding on to each end a piece cut from the uninjured portions of old boiler tubes; the welding was done by the ordinary forge process, and gave quite satisfactory results.

Ordinary commercial glass tubing, bought by the yard, was used perforce instead of special gauge glasses. Breakages were rather more frequent, but the overall cost was lower.

Turbines Operated without Governors.—In 1916 the governor gearing of an 8,000-kw., 1,500 r.p.m., turbine was put out of action. This gearing consisted of a steel ring keyed to the turbine shaft and provided with a triple thread driving a bronze wheel on the governor shaft. When the wear in the gearing became so great that dangerous vibration was set up, the bronze wheel was built up with hard white metal, but the latter was worn away in 24 hours. A steel tube of twice the length of the worm was then threaded, and one-half was used as a hob to cut teeth in a cast phosphor bronze wheel. The new gearing thus made, ran sweetly at low speed, but despite repeated attempts, could not be made to operate satisfactorily at turbine speed. This was hardly surprising since even turbine builders generally obtain these gears from firms specialising in their manufacture.

The only alternative to leaving the turbine out of commission was to run it without a governor, and to rely upon the other units in parallel to maintain speed regulation by synchronism. Theoretically this expedient should be satisfactory, provided that the steam admission were regulated so that the output of the defective turbine was always well below the total load on the generating station. This condition was fulfilled at Baku, the total station load being nearly constant at 20,000 kw. There was, however, the risk that the turbine would race in the event of a general shut down of the station, or if the defective set fell out of step; the runaway governor, not always infallible, remained the only safeguard against such a mishap. The risk had to be accepted, and, after trying the turbine without a governor at reduced speed, the set was fully loaded, and has operated satisfactorily ever since.

Some time afterwards the same mishap occurred to the governor of a similar turbine in another station 25 km. away from the main station, and connected to the latter by an overhead 20,000-volt line. The other sets in this station supplied a different network, and had characteristics different from those of the damaged turbine; parallel operation was, therefore, impossible. The defective machine could only be operated in parallel with the sets in the main station, and this course was adopted notwithstanding the risk introduced by the overhead line. On the occurrence of a breakdown in the latter the change in sound of the defective turbine always warned the attendant and enabled him to control the machine before the emergency governor came into action. On several occasions during prolonged breakdown of the line between the two stations, the isolated defective turbine was controlled by hand for 10 or 12 hours.

For more than three years two of the most powerful of the four to six sets in service were operated without governors.

Failure of Blades in A.E.G. Turbines.—Nearly all the turbines in these stations were by the A.E.G., and were of a mixed type, there being first a two-stage Curtis impulse wheel and then a variable number of reaction wheels. In leaving the nozzles in front of the impulse wheel the steam expanded from 12 to 1 atmos., this wheel alone developing about three-fourths of the total power of the turbine. Suspicious sounds were heard one day, and on opening the turbine it was found that two of the diaphragms separating the reaction wheels had given way under the pressure difference to which they were subjected, and had thus fouled the adjoining runner wheel. These diaphragms derived no support from the shaft which passed freely through them, and the accident was due to breakage of the supporting guide vanes between the diaphragms and the turbine casing. It was found that the metal of these vanes had oxidised throughout its thickness, and that the supporting attachments of the remaining diaphragms were in practically the same state. The oxide was hard and brittle and looked like tarnished metal, but a test with a file at once revealed its true nature.

Fragments of the broken guide vanes having destroyed the blading of the adjacent runner wheels there was nothing for it but to eliminate the damaged diaphragms and runner wheels, replacing the latter by rings on the shaft to secure the remaining wheels. Those diaphragms which were intact but doubtful were reinforced by steel rings. The balance of the rotor was then checked, and the turbine was restored to service. The output of the machine was reduced slightly, and the steam consumption was increased considerably.

This trouble being due to unsatisfactory composition of the guide vanes it was naturally experienced in other machines of the same make. Out of six A.E.G. turbines of from 4,000 to 8,000-kw. rating, four have lost two or three wheels in the above manner. "A brilliant advertisement for the makers," says the author, "three of the turbines having been in service only three or four years when the failure occurred."

Condensers.—Sea water was used as the circulating water in the condensers, and the number of tube failures was serious, probably owing to the brass used being unsuitable for local conditions. The condensers for the four older turbines gave no trouble, but all the tubes in those for the four newer sets were attacked heavily. Attempts were made to repair the damaged tubes by cleaning them, tinning them all over, and then filling with solder any holes not closed by the tinning process. The repaired tubes were tested under air pressure, and when replacing them in service, that side which had been at the bottom was placed at the top. This method gave good results in the case of pinholes and narrow fissures, but where there were larger holes the repaired tube did not last long.

Attempts were made to repair the tubes by electro-deposition of copper, the tubes being kept in rotation in the plating vat. Poor results were obtained, and eventually a supply of short tubes was obtained, and they were lengthened by soldering pieces of old tube on to them. The author thinks that the electrolytic process might have been made successful by running a low-melting-point substance into the tubes to form a mandrel and metalising the surface of the mandrel at the holes.

Alternators.—The most interesting incident in connection with the alternators occurred when the insulation on one of the stator bars broke down, establishing an "earth" to the laminations. This breakdown occurred after 30,000 hours' operation at full load, and was due merely to fatigue and general deterioration of the insulation. As the neutral point of the windings was not earthed the circuit breaker did not operate, and by the time the fault had been located the bar and the laminations had fused together and formed a solid block of metal around the site of the fault. With a view to saving time the stator was not unbuilt in the first instance. Instead, the damaged bar was removed, the slot was milled, and the block formed by fusion of the laminations was removed in much the same way as a dentist removes the decayed portion of a tooth. This process, owing partly to the nature of the tools used, formed burrs which still short-circuited the laminations, although the block of metal had been removed. In order to investigate the extent to which these burrs would conduct eddy currents, a dummy bar of wood was inserted in the slot, the stator winding was left open, and the machine was brought up to speed. The machine was then excited, but before the field current had been brought up to full strength the dummy bar caught fire. No better demonstration of the importance of eddy currents could be desired, and it was obvious that the stator plates would have to be taken apart. On doing so it was found that the paper between

* Perhaps also they will inspire some of these engineers to recount their own difficulties and solutions thereto for the benefit of other readers.—Eds. Elec. Rev.

laminations had been charred for a considerable distance around the fault, and this fact no doubt contributed to make the eddy currents so serious. Sixty women, working night and day in three shifts, took three weeks to clean and re-paper the laminations. Meanwhile, a considerable amount of repair work had to be done on the insulation of the bars which had become brittle and was injured extensively in removing the bars from the slots.

Two 12,000-K.V.A. sets broke down in the above manner, and the repairs took from four to six weeks in each case.

Transformers.—Several transformers of from 500 to 2,000 K.V.A., 6,000/20,000 volts, burnt out during the war. In the smaller units, using thin cotton covered wire, re-insulation was impracticable without special machines, and new cotton-covered wire was, therefore, substituted for the damaged wire. In the larger units cotton tape was used to re-insulate the damaged portions, and when the supply of twilled tape was exhausted, pieces of long cloth were cut into strips 2 cm. wide and used with perfectly satisfactory results, except that the final appearance was not quite so neat.

In 1916 two new transformers, 2,000 K.V.A., 6,000/20,000 volts, were received without tanks. It was not practicable to build at Baku tanks with cooling pipes or fins, &c., and plain tanks of adequate cooling surface could not have been accommodated in the space available. The largest plain tanks which could be accommodated would not have permitted more than half the rated output to be obtained from the transformers. Circulation of oil through coils in water tanks, or of water through coils in the oil tanks, was considered; both of these methods were already in use with 3,000 to 10,000-K.V.A. transformers, but material could not be obtained to equip the new transformers in a similar way.

The transformers were, therefore, provided with plain tanks of medium size, and these were placed in cemented wells in the ground, slightly less deep than the height of the tanks. Water circulation through the well was provided by a tube entering at the bottom and an overflow at the top of the opposite corner. The water level was lower than the level of oil in the tank by such an amount that, in the event of leakage, oil would flow outwards into the water, thus giving warning of the leak and preventing ingress of water to the tank.

Thus arranged, the transformers operated successfully for three years carrying full-load and even overloads without exceeding permissible temperatures, even when the surrounding atmosphere was at 40 deg. C. (104 deg. F.).

THE DISTRIBUTION OF ELECTRICITY.

Discussion at Birmingham.

At Birmingham, on December 15th, Mr. W. B. Woodhouse's paper, which was abstracted in our issue of December 3rd, was discussed before the South-Midland Centre of the Institution of Electrical Engineers.

The discussion was opened by Mr. R. A. Chattock, who heartily endorsed the paper, but he thought that the formulæ used throughout the paper were not at all easy of application; Mr. Woodhouse did not give any idea of the probable value of the constants that would apply in practice. He specially emphasised the point Mr. Woodhouse raised in connection with pressures of supply; in a large distribution system, certainly three pressures had to be adopted, and quite likely, four. In the Birmingham district they had the low-pressure that was applicable to individual consumers, then a 5,000-volt, E.H.T., 3-phase supply which was given to large consumers and to sub-stations, and was the pressure of generation; also there were now being installed trunk connections to outlying districts at a pressure of 30,000 volts. Whilst this was desirable and suitable for large-capacity trunks, it was too high for the smaller-capacity transmission lines which might be required for supplying the villages and agricultural districts within a radius of 10 or 15 miles from Birmingham; 30,000-volt underground cables had, for mechanical reasons, to contain a certain size of copper conductor, which fact limited their minimum capacity to about 7,000 KW. Such a capacity was too great to lay all over a country district, and on this account it would probably be found advisable to adopt an intermediate pressure of 10,000 volts for this class of supply, and to confine the 30,000-volt cables to transmitting large supplies to well-defined centres. Mr. Chattock felt that interconnection of networks could be carried too far; whilst the possibility of interconnection should be provided for, the actual connection should be broken so that the networks could be split up into easily handled units. Where several generating stations were employed, it was essential that they should be connected together by large-capacity trunk cables. At the same time, it was undesirable to connect together the centres of distribution external to the stations in a permanent manner, as in case of a disturbance on the system, it was quite possible that the generating stations might be disconnected on the trunks, and that the connection on the distribution system might remain, with the result that the latter would become heavily overloaded, and the switches controlling such connection would be called upon to handle more than they were probably designed to do. In order to keep the expenditure on switchgear throughout the network, both on consumers' premises and in sub-stations, within a reasonable figure, smaller switches would have to be employed, and the power that could pass through them would have to be limited by reactance. This control also took a certain amount of strain off the transmission and distribution cables. Mr. Woodhouse confined himself to A.C. distribution, but most large industrial centres were supplied with D.C., and the advantages of the latter, both as regarded safety, flexibility of manipulation, and general steadiness of supply, were well recognised. The speaker, therefore, reminded Mr. Woodhouse of the possibility that had recently been developed of supplying D.C. to outlying districts on as economical a basis as A.C. by means of the mercury arc rectifier. This apparatus could be installed at points along the line of an E.H.T. feeder, and could supply D.C. to L.T. distributing cables in the same way that a static transformer supplied A.C. to similar networks. The heavy cost of L.T. feeders from transformer sub-stations was thus done away with, and also the heavy cost of operating such sub-stations. This method of transformation would be ultimately applied to railway electrification. The apparatus was being used in Switzerland for tramway supply, and he was proposing to experiment with it in Birmingham on the same lines.

Mr. W. Wilson said that electricity supply enterprises could be divided into two classes. First, a district wherein a demand for electric power had grown up, which had been partially satisfied after a considerable time had elapsed, by a purely local scheme that managed to keep a number of years behind the requirements throughout the whole of its career. The second class was exemplified by most hydro-electric enterprises. The average man with money to invest, who came face to face with a waterfall, or even a rapidly flowing river, immediately began to make plans for putting capital into a development project without making any rigid inquiry about the existence of a payable demand. When such a scheme was carried out, from its very nature, it was undertaken on a generous scale, and it was hence designed with every chance of being economical. There were critics of every hydro-electric project, yet he had never heard of a case where such a scheme failed on account of too small a demand; given the demand, there was no doubt about the economic success of the undertaking.

Major A. M. Taylor (see correction on p. 820 of our December 24th issue) explained that he had until recently assumed that the rotating field of a 3-phase current did not induce serious eddy currents in the lead sheathing of a cable. He now believed, however, as a result of some experiments, the nature of which he was permitted to indicate, that the losses in the lead sheathing due to the rotating field were very much greater than was generally realised, and far outweighed those due to hysteresis. By the methods adopted by electricians for measuring the losses in their cables, it was difficult to discriminate between those due to hysteresis and those due to eddy currents in the lead sheathing. The experiments to which he alluded were made at a frequency of 25 cycles, and the principle adopted was to take two pieces of identical cable, but in the one case armoured and in the other case unarmoured, to pass identically the same current through them, and to compare their relative rises of temperature over such a time that practically constant rise was obtained. Direct currents were first passed through the cables in series and the temperature rises noted. Under these conditions no eddy current or hysteresis losses could possibly occur; this condition represented the minimum temperature rise. The next experiment was to pass through the two pieces of cable, in series, a 3-phase current of such a value that the C^2R losses in copper were identical with those obtaining with the D.C. The third experiment consisted in passing a single-phase A.C. through the two cables, arranged to give the same C^2R losses as in the case of the D.C. This last experiment, compared with the previous experiments, gave a means of differentiating the eddy current losses in the lead sheathing due to the rotating field from that due simply to the pulsation of the current. The magnetic axis of the rotating field being on a diameter of the cable and the rate of rotation of the field being controlled by the periodicity, it followed that the armouring of the cable formed a path for the magnetic lines which was normal to the direction of magnetic flux and, therefore, the armouring had practically *no effect* upon the strength of this rotating flux. In the case of the single-phase current, however, the armouring was absolutely upon the path of the magnetic flux, and consequently very greatly affected the strength of this flux. This latter explained the difference that would be observed between the behaviour of the single-phase current in the armoured cable and in the unarmoured cable (see Table I). The speaker added that there was no opportunity of hysteresis occurring in the above tests, which were carried out at a very low voltage. The three principal points deducible from the tests were: (1) That, with 3-phase current, the total losses in the armoured and unarmoured cables were practically equal. (2) The losses in the unarmoured cable with 3-phase currents were 62½ per cent. greater than with D.C. (3) The losses in the unarmoured cable with single-phase current were only 12½ per cent. greater than with D.C. Since the result obtained in the case last mentioned was included in the 62½ per cent. for the 3-phase losses, it followed that, of the 62½ per cent. above given, no less than 50 per cent. was due to the eddy current losses as

caused by the rotating field, while only 12½ per cent. was due simply to the pulsations of the field. From these results he submitted that it was readily deducible that *a very great saving* in the eddy current losses in the lead sheathing could be effected by resorting to single-phase currents in the case of long-distance transmission, where the improvement in maximum voltage gradient was effected by the use of single-phase cables, on the lines indicated by Messrs. Clark and Shanklin (in their paper before the A.I.E.E. in June, 1919); also that the losses with D.C. were the ideal towards which they should aim, and which could be reached within 12½ per cent. by using single-phase cables. It was also to be expected that with a current of 50 periods the losses in the lead sheathing, with single-phase cables, would be distinctly higher than with 25 periods. This, if corroborated (and experiments were being made with this end in view) should indicate the desirability of 25 periods for extremely long-distance transmission. It was obviously not in the best interests of the maintenance of insulation of E.H.T. cables that there should be an unnecessary loss in the lead envelope amounting to 50 per cent. of the copper loss. Another feature deducible from the above tests was that the practical equality of temperature rise in the armoured and unarmoured cables with 3-phase currents, proved conclusively that the armouring had no material effect in this case, as in fact would be expected. It only remained to add that in order to emphasise the results, the current densities were increased to about 1,500 amps. per sq. in. in the 3-phase tests, which, however, was not in excess of that indicated by Kelvin's law at voltages between 20,000 and 30,000.

TABLE I.

Current	D.C.	3-phase	1-phase
No. of cores utilised	1	3	1
Current per core (amps.) ...	400	230	400
Class of cable	3-phase, 6,600 v.	do.	do.
Temp. rise (deg. F.), armd.	23	37	38
Temp. rise (deg. F.), unarmd.	23.7	38.5	26.7
Rise % above D.C. (taken as ideal). armd.	nil	61	65
Rise % above D.C. (taken as ideal), unarmd.	nil	62.5	12.5

Hysteresis losses were negligible, and in the first and third experiments the thermometer was tried at different points round the cable so as to check any unequal heating.

Discussion at Cardiff.

At a Cardiff meeting of the Western Centre Mr. W. B. Woodhouse's paper was discussed on December 6th.

The Chairman (Mr. A. J. Newman, Bristol) noticed that the author mentioned that the revenue rarely exceeded a quarter of the capital involved; he could confirm this figure at the present day, but in Bristol they had had to survive for many years past on a very much lower ratio. The author's system of analysing load factors and load losses was most illuminating; he had no idea that there was so much in the subject, being content to use a planimeter.

Mr. A. Nicholls Moore asked whether it was desirable to have two different high-pressure (2,000 and 11,000 volts) mains to consumers. An excellent curve was given in which was shown the cost of cables laid in ground; had the author given another curve for one particular section of cable he would have given some very illuminating information. The author assumed the cost of overhead lines as proportional to the pressure, but later he said the cost was not likely to increase as rapidly as the working pressure. That was misleading, because if in one case the cost was proportional to the working pressure, it would increase as rapidly as the working pressure. Apart from that the cost of overhead lines would vary in proportion to the working pressure. The author pointed out that the working costs were proportionate to the load factor; but something should be taken into account for diversity factor and stand-by charges apart from standing charges. In the formulæ it would have been of greater advantage had he made it clearer how the different functions were arrived at.

Mr. J. W. Burr agreed that future manufacturing prosperity must depend largely on the provision of a cheap and reliable supply of electricity. If they were to run transmission lines without considering the annual cost, he did not see how a cheap supply of electricity was possible. Transmission lines involved vast sums of money, and it must be borne in mind that in addition heavy annual capital charges would also have to be met. For many years the transmission lines would not be remunerative, and the only way those charges could be met was either by financial assistance from the Government, or by increasing the charges to the consumers. The most economical method of generating electricity was not by erecting huge super-stations and distributing over a wide area, but by inter-linking central stations 20 or 30 miles apart. The author raised that point in connection with the inter-linking of mains; these mains ought not only to be used for supplying consumers on route, but also for taking a supply from waste heat. On his way down from Swansea he noticed many huge jets of flame playing into the air. If that heat were used for the generation of electricity it would be the source of a cheap supply. He supported the author's suggestion that they should have at least three pressures. In Swansea they had decided to use 200 volts for small consumers, 6,000 for large ones, and 30,000 for transmission purposes was being considered.

Mr. A. Ellis thought the paper came at a very opportune moment. The question of transmission was a very important one; at the moment he was dealing with three schemes where 33,000 volts had been decided upon, together with an intermediate high-pressure as well as a low-pressure system. With regard to the various forms of protection, his view was the simpler the form the better the results obtained. Some systems were so very sensitive as to make one feel almost inclined to superimpose in order that the first should not unnecessarily operate. Switchgear was the most serious item of capital expenditure in any comprehensive scheme concerning a bulk supply.

Mr. W. Nairn referred to step-by-step development, and thought that three steps were necessary. As matters stood at present, they had taken two of these steps—extended their low-tension network at 440 volts, 4-wire, until it could no longer support itself, and the second step was the superimposing on it of a 10,000-volt network. This second pressure had proved suitable for distribution within a 10 mile radius from the source of supply, *i.e.*, for an area of about 300 sq. miles, but the 10,000-volt network was now being so extended and loaded that they had to consider taking the third step. That, so far as he understood it, was to superimpose on the 10,000-volt network a still higher pressure network, both high-pressure networks being completely interconnected and protected. The consumers on the third network would be in areas of about 300 sq. miles. The voltage for the third network was not yet defined. At the recent inquiry into the London distribution a voltage of 40,000 was mentioned, and 120,000 had been mentioned in connection with the Severn scheme, but the author's statement that a cable was now available for a pressure of 60,000 volts gave them a good indication of what the third voltage was likely to be. In limiting their third voltage to a value which could be carried by a cable, they could not take advantage of the ability of overhead lines to carry much higher pressures, but he did not think they could make use of such in this country. The third network would be transmitting large amounts of power, the author mentioned a main carrying 50,000 K.V.A., and for maximum economy the mains must be carried right into the heart of the load, which was not practicable with overhead mains.

Mr. W. A. Chamen agreed with the general conclusions of the author. The chief difficulty was that of capital, and in laying out a distribution scheme for future development, who was going to find the interest on the capital? Wireless transmission might eventually come in. Another serious question was the very high pressures necessary in order to get an economical supply for a large area. He was appalled at the cost of transformers, switchgear, &c., and felt that from the point of view of economy high pressures would not be wanted.

Major E. Ivor David agreed that for the general system of transmission three voltages were ideal, in fact, they were the pioneers of the system the author had described. He did not agree that the cost of overhead lines increased with the pressure. Load factor on a general system was a much more difficult matter than that of a colliery, because in the latter they had means of balancing the load. During the day shift their average load factor was 96 and during the off shift about 80 per cent., due to the fact that they had to run certain heavy machines such as winders. When it came to load factor per machine installed, colliery load factor was about the worst one. They were naturally bound to put sub-stations in colliery districts, but sub-station costs should not vary very much over the whole country. Until the prices for switchgear came down extension of high-tension distribution in this country would be retarded.

Mr. I. A. D. Pedler, in a written communication, said with regard to the area of supply that it would be as difficult to attempt to determine the total amount of power to be provided as it was to estimate for the heating and domestic load of a large city, but as one would be dealing with a specific area, reasonably large copper sections should be allowed for (more particularly with underground trunk mains having regard to the high excavation costs). Comparatively high pressures should be utilised to ensure the pressure on consumers' premises being maintained within the Board of Trade limits when the scheme was finally completed, bearing in mind the abnormal pressure drop in transformers due to poor power factors and peak loads. He was in agreement with the author's remarks with regard to the step by step transformation in bringing up the working pressure, &c., provided that the period of development was reasonably long. If the original cables laid, or insulators installed, would be capable of giving good service on the highest pressure which would be ultimately applied, then switchgear, transformers, &c., would have to be changed, involving expense which, added to the high cost of the original installation of underground and overhead lines, would probably condemn the transformers for a short period of development. With interconnected stations boosting regulators would of necessity be installed, and, provided the pressure at the distributing centres and the consumers' premises could be maintained within the

Board of Trade limits, the proposition of feeding the distributing centres from the interconnecting lines was a good one, otherwise care should be taken to provide apparatus at the distributing centres to deal with the regulation problem. His experience was that the faulty apparatus period was not yet over, and as long as apparatus was passed out of the factories without undergoing a more strict mechanical test, particularly with regard to the protective portion of the gear, by specialised engineers, they were still likely to experience considerable inconvenience either by having to put gear right before it went into commission, or by regrettable experiences when in commission.

Mr. W. B. WOODHOUSE, in reply, stated that the chairman had raised the vital point, namely, capital expenditure. Although it would be very helpful from a technical point of view to lay down a system to meet probable developments it would be hopelessly uncommercial. One could only afford to look a reasonable time ahead; that time was really determined for them. He did not think that State doles were going to do the slightest good. Good consumers came on to the mains slowly, when it paid them, and that was the justification for the intermediate voltage. The use of waste heat was a point he was very glad to have had raised. One big advantage was that one could pick up small amounts of power which would be a very economical arrangement. He regretted that the Government had put forward the Severn scheme in such a cheap journalistic manner; it was calculated to make every thinking man question the soundness of the scheme. Regarding protective devices, his own feeling was in favour of simplicity; protective devices required a great deal of maintenance, and his advice was to spend money on improving the apparatus. When they came, however, to the interconnection of very large power stations they must have protection, and he thought they would improve. The high cost of switchgear was a very serious matter, and was hampering development. With regard to the size of high-pressure cables, figures had been submitted by the makers for 0.15 sq. in., 60,000-volt cable, with an overall diameter of 3 in. over the lead. The reference to the transmission of 50,000 K.V.A. by one main was to an overhead line for which one would use a pressure higher than 60,000 volts—not more than 20,000 K.V.A. on a main. He thought the current density ran out to about 800 amperes to the sq. in., the temperature rise was, he believed, 50 deg. C. He saw the advantage of split-conductor, 6-core cable, but, generally speaking, from the point of view of heating, a 6-core cable was wrong; he would have two 3-core cables in preference.

REVIEWS.

Electric Welding: Its Theory, Practice, Application, and Economies. By H. S. MARQUAND. Pp. 204; 90 figs. London: Benn Bros., Ltd. 1920. Price 12s. 6d. net.

The wartime and post-war developments of electric welding, especially arc welding, have naturally led to a crop of papers, articles, and books on the subject. The one now under review, whilst without features of great novelty, has its value for the would-be welder, especially the arc welder, because it is written by a man with extensive practical experience in that work who sets out in clear language many of the points to be remembered and the methods and precautions to be observed for the satisfactory execution of various kinds of work. The chapters which include this practical instruction are those from Chapter VI onwards, and one is inclined to think that the book would have been of higher quality as a manual of instruction if the greater part of the previous chapters had been omitted, and the later ones amplified. The object of writing the earlier chapters was doubtless the entirely praiseworthy one of introducing the practical part of the book by a survey of the general principles, chemical, metallurgical, and physical, involved in the process, and something of an historical sketch of the better-known methods of soldering, welding and similar ways of joining metals. The intention is good, the execution necessarily imperfect. Space forbids adequate treatment of so large a group of subjects. Unfortunately the faults of the execution cannot be entirely ascribed to the need for brevity. There are a number of statements which are distinctly misleading, not only from incompleteness or isolation. This is particularly unfortunate in a book which seems to have for its main object the instruction in an industrial application of scientific facts, of those who are not necessarily well versed in the general sciences which are to be applied.

The first chapter purports to be an historical review of methods of making permanent metallic joints. It covers smith's welding, soldering, brazing, thermit welding, riveting, blow-pipe autogenous welding, and electric welding. It might have been made more definitely analytical with advantage. The description of thermit welding is strangely inaccurate. The result of filling the *mould* with thermit mixture and firing it there would not be satisfactory. It is not the method practised. It would not be admitted by the makers of ships, boilers, and other riveted structures that the strength of riveted work is subject to such rapid and great deterioration as the author suggests. The statement is made that the Egyptians, Greeks, and Romans attained considerable skill in autogenous welding of soft metals with the blow-pipe. Evidence for this statement would be very interesting. It is not suggested that it is inaccurate.

The second chapter studies the properties of metals considered from the welding point of view. This is an exceedingly necessary study for the understanding and development of electric welding. It cannot be summarised in eight octavo pages as here attempted, but one thinks that the attempt might have had a better result with a little more care. There is a table given of specific heats of metals, but no attempt to show by an example how this property enters into the question of the energy needed for welding. In fact, neither specific heat nor the unit in which the quality is measured is explained. The variable heat of fusion, equally important, is not even mentioned. Heat conductivity and its consequences are very slightly touched on, yet these are vital. The statement is made that "the same power or intensity of heat" is required for welding copper of given dimensions as for steel, despite the lower melting point of copper. "Power or intensity of heat" is not an exact expression. If the author means the same energy, the statement is wrong. A great deal more energy is needed for copper, as certain curves, &c., in other parts of the book show. The equally vital subject of oxidation is dealt with too loosely. The author says (p. 23), "it is of great importance that all the possible ways of neutralising the oxide and cleansing the weld of its presence should be known to the welder. Hence we shall investigate the more common metallic oxides and describe their fundamental differences." Unfortunately the author does nothing of the kind. Instead, there are three short paragraphs classifying metallic oxides in respect of (*a*) their weight, (*b*) their fusibility, relative to those of their parent metals, and (*c*) stating that some oxides are soluble in the molten metal. But which oxides and which metals show these characters, and the scales of the differences, is left unsaid. The parts of this chapter dealing with blow holes, their causes, &c., expansion and contraction, and the mechanical qualities of welds are of a more useful character.

There is quite a lot of information given about resistance welding in Chapter IV, with numerous illustrations of resistance welding machines. Also a description of the operations of chain making and welding machines. The description of the bending and link forming may be quite accurate, but it is impossible to follow intelligently in the absence of detailed drawings of the machine parts, and, moreover, it has nothing directly to do with welding. The space might have been better used on other things. The curves (figs. 16-20) indicating the power and energy required for certain resistance welding operations are useful, but some of them seem incomplete. Fig. 18 seems to have a curve omitted, at least there is a scale which does not apply to those included, and the legend has a misprint. The curve does not go to 5 sq. in. of cross section. It may be mentioned that from these curves equal sections of copper and iron appear to require about three times as much power (KW.) for copper as for iron. How this compares with the vague "power or intensity of heat" above quoted is not certain, but it suggests wide inequality.

It always seems ungracious to pick out the faults in a technical book where the author is trying to put his own hard-earned experience at the service of his fellow craftsmen—for a quite trifling remuneration—and the present reviewer will not pursue this uncongenial line. It has only been done so far to indicate that the book must not be taken as a short and straight cut to the physics of electric welding, nor as an exact authority on the scientific matters involved.

There are one or two points in the more valuable part of the work which one cannot pass over. The illustrations and diagram of connections of welding generators are not accompanied by sufficient explanation of their action to be of much value. They do not definitely state that these small steam or petrol sets can only supply a single welder at once, and why. Exactly what the author means on p. 85 by: "A motor-generating welding set may not be continuously rated, and gives far more pleasing operating conditions than a steam or petrol set," has made the reviewer scratch his head—metaphorically. Perhaps rather more has been done in the design of transformers for arc welding than the author has heard of, but he is hopeful for further improvement.

It is rather suggested than definitely stated in the book that the arc welding of aluminium, copper, and some copper alloys is practicable, if not in common use. More light on this very important subject would be welcome.

On p. 95, in two places and similar words the author states that the "flux" coating of a metallic electrode can "be a flux containing various constituents to give the desired characteristics to the deposited metal and to supply to the welded stock the elements which are liable to be eliminated by the heat of the arc. The writer has concluded after a great amount of research work that this system is the best for commercial welding. . . ."

On p. 187 there is the following statement: "The author ventures to state emphatically that no external covering of the electrode, whether in the nature of a refractory liquid flux, or a gaseous flux-forming substance, can in any way influence the chemical or physical state of the weld apart from protecting the metals in fusion from the surrounding atmospheric gases."

This direct and unmistakable contradiction may well puzzle the reader, nay, it may even puzzle the writer.

The reviewer ventures to think that the first statement has the better support from practice.

There are some very good suggestions on the vexed questions of tests of welds. Proper weight is laid on the value of microscopic investigation, though no figures or descriptions of good and bad structure are given (there is a figure of two welds showing good and bad *fusion*, which is not the same thing, and they are not magnified appreciably), or of the relation between working methods and such structures. Without such examples and instructions from some one, it will be a little difficult for the welder—as the author suggests—to examine the test piece microscopically and recognise his defects. The use of the microscope for the purpose is not a recognised part of the welder's education, though it would be all to the good if it were.

Tables and curves of cost and rate of cutting and welding are given which are of considerable value, especially table 17, which gives the actual cost to the customer of a number of jobs illustrated in the book. Naturally they must be used with a good deal of discretion for arriving at the probable cost of even similar work. The illustrations of work actually done, and those showing the methods of preparing work for welding, with remarks as to good and less good alternatives, are among the most valuable features of the book. This is where the author draws on his experience to help his colleagues. The list of papers and books on welding which completes the text, and the index to the illustrations are good points which entitle the book to a place in the reference library of anyone interested in the subject.—H. M. S.

A Course in Electrical Engineering. Vol. I. Direct Currents. By C. L. DAWES, S.B., Assistant Professor of Electrical Engineering, The Harvard Engineering School. Pp. 496+xiv; 411 figs. The McGraw-Hill Book Co., Inc., London and New York. Price 25s. net.

This book, the author states in his preface, is intended to cover a preliminary course for students specialising in the subject and to act as a stepping-stone to the study of more advanced works; also to act as a suitable text book for students specialising in other branches of technology, and taking elementary electrical engineering as a subsidiary subject, and for men taking industrial courses in electrical engineering, such as are met with in evening classes.

The early chapters deal with general electrical principles, and it is pleasing to see the prominence accorded to Kirchhoff's second law, a valuable weapon for solving problems concerning the current distribution in networks, and one to which due attention is seldom paid. The subject of electrostatics also receives a fair share of attention.

A lengthy chapter is devoted to electrical measuring instruments and their uses, and in this connection too little importance seems to be attached to ammeters and voltmeters of the moving iron type. Their robustness and low cost, combined with an accuracy which is sufficient for many purposes, would seem to warrant a more detailed account. The single example described dates from the very early days of direct reading instruments, and is not at all typical of modern designs.

Matters relating to the construction and operation of continuous current machines are described at length in a very satisfactory manner, many important points which are often dealt with superficially being thoroughly investigated. The final chapter gives a useful, though brief, account of the usual arrangements for the transmission of power, and the work concludes with a large number of useful examples both of a descriptive and of a numerical nature.

The book is essentially one for students and, as such, is quite one of the best we have seen. It will serve not only as a manual in class and lecture rooms, but in the laboratory as well, special attention being paid to methods of testing in all branches of the subject. The book is well got up, and the diagrams are numerous, well drawn, and useful.

The Rudiments of Electrical Engineering. By PHILIP KEMP, M.Sc. (Tech.), M.I.E.E. Pp. 255+viii; 94 figs. London: MacMillan & Co. Price 6s. net.

The author states in his preface that his book is written for non-mathematical readers, and he hopes "that it will serve to spur on those whose daily work lies in the midst of electrical apparatus."

He starts with clearly written chapters on general principles, power and energy, and magnetism. These should be readily followed by almost anyone, and contain quite useful elementary matter. Thereafter he deals in nineteen chapters with subjects ranging from primary cells and bells to alternating currents and electricity supply. The reviewer is at a loss to know how the space was adjudicated to the different chapters as alternating currents are dealt with on eleven pages while six are devoted to bells. This hardly gives a fair idea of their relative importance, even to the artisan.

All the descriptive chapters are only gossipy accounts of apparatus, which is far more concisely and accurately dealt with in almost any elementary electrical handbook.

There is practically no mention of such important and interesting subjects as electric traction or the physiological effects of electricity. On the other hand, the all-conquering kinema has a chapter to itself.

The reviewer noticed only one or two very slight arithmetical errors. These occurred in a table of current consumptions of lamps (p. 160), which in any case would have been better omitted. It is entirely valueless to the reader if he has grasped the simple principle at all. There is a slight grammatical error on p. 202.

The printing and reproduction of the figures are very good. The figures themselves are mostly line diagrams of little value, but a full page is very appropriately devoted to an illustration of a cooking stove.

The high qualifications and eminent position of the author make it certain that there is a market for this class of book. The reviewer, however, regrets to state that he cannot recommend it to anyone.

THE SOUTH WALES ELECTRICITY DISTRICT.

A LOCAL CONFERENCE.

A CONFERENCE was called by the Right Hon. the Lord Mayor of Cardiff (Ald. James Taylor) on December 3rd, and was held at the City Hall, Cardiff, on December 21st, to consider the South Wales Electricity District which has been provisionally determined by the Electricity Commissioners (see p. 591 of our November 5th issue), and means of improving the existing organisation for the supply of electricity therein. The Lord Mayor formally welcomed the 130 odd delegates to the conference, who represented company and municipal electricity supply undertakings, local authorities, collieries, railway and traction undertakings, and other large consumers and interested parties. After suggesting that Mr. W. A. Chamen, engineer and general manager of the South Wales Electrical Power Distribution Co., and chairman of the existing South Wales and Monmouthshire Linking-up Committee, should be elected to the chair, he read a letter from Mr. W. Gascoyne Dalziel, chairman of the South Wales Electrical Power Distribution Co., expressing regret at the writer's inability to attend the conference owing to absence from the country, and setting out the principles of a co-operative scheme which was being successfully worked by the Treforest Electrical Consumers Co., Ltd., which operated the South Wales Electrical Power Distribution Co.'s undertaking, under statutory authority, which he would have wished to put before the meeting, and which his company suggested would form the best nucleus of a scheme for improving the supply of electricity in the South Wales Electricity District.

Mr. W. A. CHAMEN, who was unanimously voted to the chair, explained that the South Wales and Monmouthshire Linking-up Committee, consisting of the engineers of the principal statutory undertakings in the district, which came into existence at the instance of the Board of Trade in 1916, had recently given considerable attention to the question of the proper boundaries for the South Wales Electricity District, and found no fault with the district as provisionally determined by the Commissioners, except that perhaps the two extreme eastern districts of Monmouthshire might have been included, though there were, perhaps, some grounds for their inclusion in the Lower Severn District. The primary factor in any scheme was finance, and, in the circumstances of general financial depression and consequent clouded vision which now obtained, it might be deemed unwise to plan any scheme which might be warped owing to the distorted conditions prevailing during its conception, and which might not be at all the best scheme under the conditions which might exist at the time it became an accomplished fact. He doubted if the Commissioners would have fixed April 30th, 1921, as the last date for the receipt of representations and schemes if they had been issuing their notice in the circumstances which existed that day, and it might be desirable to consider whether they should not be asked to postpone that date and the subsequent inquiry for a time.

Mr. ARTHUR ELLIS, who represented several local authorities within the area and, particularly, the Monmouthshire County Council, referred to the Act of 1919 as a Parliamentary measure which must be accepted as an existing fact and acted upon, no matter whether it met with approval or not. He suggested that the present Linking-up Committee, together with any fresh members it might co-opt, should try and evolve a scheme. The Lower Severn Scheme would be accepted by the Commissioners, regardless of any opposition, and a good deal hinged upon the electric power station erected by the Government at Beachley, which was acknowledged by common consent to be a "white elephant." He objected on principle to the kind of scheme outlined in Mr. Dalziel's letter, because, apparently, local authorities would only be supplied with power if they were shareholders in the co-operative scheme, and they would have no authority in the management of the concern. On behalf of the Monmouthshire County

Council, he strongly objected to the county being divided so that part of it would be in the Lower Severn District and the remainder in the South Wales District. The difficulty of obtaining money would exist under the co-operative scheme as under any joint municipal or local authority's scheme. He also referred to the legal difficulty about local authorities investing money in companies.

The CHAIRMAN asked what alternative could be offered in place of a co-operative arrangement, unless it were some scheme secured on the rates, which must react primarily upon the large industrial concerns as being the largest ratepayers.

Mr. W. ANGUS SCOTT (Tredegar Iron & Coal Co., and Messrs. John Lysaght & Co.), speaking on behalf of several large industrial interests, said that from their point of view any venture for raising capital upon the security of the rates would be considered most objectionable. A scheme of his in Yorkshire had increased, by linking together 12 installations of mining plant, the available power by 50 per cent. He would favour the consideration at an early date of such possibilities in the South Wales District.

The CHAIRMAN, in reply to a question, explained that the South Wales and Monmouthshire Linking-up Committee had tabulated a great deal of information. The S. Wales Power Company did not include the county of Carmarthen in its area, but the S. Wales Electricity District would go far beyond the limits of the power company's area. The power company was the largest statutory undertaking in the area, covering an area of over 1,000 sq. miles, having some 150 miles of transmission and distribution mains, and an output of about 56 million units per annum. It would only form the nucleus of a scheme, and must be taken into account just as the Cardiff, Newport, and Swansea Corporation undertakings must be taken into account. It would not, however, be possible to attain in South Wales what was aimed at by the Commissioners without linking together all the electricity demands, including those supplied by private industrial undertakings from their own plant; universal unification of the whole of the generating plant and systems was the only means of reaching the minimum cost of production, though, unfortunately, such complete unification was not attainable in present circumstances. He also impressed upon the Conference the fact that the aggregate capacity and output of the private industrial plant in the S. Wales district far outweighed the aggregate of all the other plant.

Mr. W. L. MADGEN (Merthyr Electric Traction & Lighting Co.) said the new Electricity Bill to be introduced in the next session of Parliament (see pp. 802 and 844 of our December 24th and 31st issues) contained definite provision authorising the investment of capital by local authorities. The only Lower Severn "Scheme" so far before the Commissioners would not be generally acceptable in South Wales. The principle of ultimate co-ordination must surely be assumed.

Sir WALTER NICHOLAS (Rhondda Urban District Council) pointed out that the Council he represented already had a mutual and satisfactory arrangement of reciprocal supplies (in connection with its refuse destructor) with the S. Wales Power Co. The right note had been sounded by the chairman. A sudden and serious financial change had come over the country, and it was now necessary to "hasten" very slowly indeed. The time was fast approaching when all sections and classes of the community must close together in unison to avoid threatened financial disaster. He suggested that a representative committee be appointed to examine the whole matter and present recommendations to a future conference. It was accordingly unanimously resolved: "That a committee be appointed to inquire fully into the whole position in the South Wales District under the Electricity (Supply) Act, 1919 (and any supplementary Bills or Acts), and orders made thereunder, and to report to a future conference, with recommendations if any are found feasible."

The CHAIRMAN read the names of the members of the Executive Committee of the Linking-up Committee, as follows: Mr. J. N. Bowman (Rhondda U.D.C.), Mr. J. W. Burr (Swansea Corporation), Mr. W. A. Chamen (S. Wales Power Co.), Mr. H. Holliday (Rhondda Tramways Co.), Mr. A. Nichols Moore (Newport Corporation), Mr. C. G. Morley New (Cardiff Corporation), Mr. J. E. Stewart (Llanelly Lighting, &c., Co.), Mr. J. E. Teasdel (Pontypridd U.D.C.), Mr. G. H. Thomson (Neath R.D.C.), Mr. Lewis W. Dixon (Merthyr Electric Traction & Lighting Co.), hon. secretary and treasurer.

It was then unanimously resolved: "That the Linking-up Sub-Committee, with the inclusion of Mr. Arthur Ellis, be the nucleus of the new South Wales Electricity District Committee," and: "That the nucleus committee be augmented by the addition of the following gentlemen, the committee being empowered to co-opt any other person or persons whose services it thinks it necessary or desirable to enlist"; Sir Walter Nicholas, Ald. J. Moxon, Ald. Col. A. Sinclair, and Mr. L. Forestier Walker, M.P. (non-technical municipal representatives); Mr. G. T. Sibbering (railways); Sir J. Wyndham Benyon, Sir L. W. Llewelyn, Messrs. E. M. Hann, W. Angus Scott, and Benjamin Nicholas (large industrial undertakings).

It was unanimously decided that a strong recommendation be made to the Commissioners to postpone for six months the date for receipt of objections and representations referring to the district and the date of the subsequent inquiry. It was left to the chairman of the conference (Mr. W. A. Chamen) to convene the first meeting of the committee, the committee being left to appoint its own chairman.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

(*Concluded from p. 830.*)

FURTHER CONTRIBUTIONS IN CONNECTION WITH THE ANNUAL FESTIVAL, 1920.

CHAIRMAN'S LIST.

	£	s.	d.
Electric Lamp Manufacturers' Association	105	0	0
London Electric Wire Co. & Smiths, Ltd.	5	5	0
Atkinson, Llewellyn B. ...	5	0	0
Photector Co.	2	2	0
Eck, Justus	10	0	0
Shirreff-Hilton, C.	1	1	0
Smith, W. O.	100	0	0
Potter, W. J.	5	5	0
Savage, H.	5	0	0
Cowie, J. R.	2	2	0
Spence, J.	5	5	0
Robson, R.	5	5	0
Harris, A. F.	1	1	0
Nalder, F. H.	1	1	0
Nalder Bros. & Thompson, Ltd.	5	5	0
Hirst, H.	105	0	0
W. T. Henley's Telegraph Works Co., Ltd.	25	0	0
Weeks, H.	1	1	0
Brooke-Hitching, Sir Thomas	5	5	0
Edgecombe, J. E.	1	1	0
Spencer, P. J.	1	1	0
Tegetmeier, C. G.	2	2	0
Barrett, G. A.	2	2	0
Rawlings, W. R.	10	0	0
Crompton & Co.	5	0	0
Phillips, C. H.	1	0	0

MR. H. BEVIS'S COLLECTION.

Bevis, H.	2	2	0
Wansbrough, E. C.	1	1	0

CARDIFF & DISTRICT LOCAL ADVISORY COMMITTEE.

Lewis, Herbert	1	1	0

MR. F. W. FIFIELD'S COLLECTION.

Jerrim, F.	0	5	0
Cassels, Dr. T.	0	7	6
Beaver, F.	0	5	0
Chapman, W.	0	5	0
Iles, H.	0	5	0
Denning, W. J.	0	5	0
Lawler, H.	0	5	0
Levy, Langfield G.	0	5	0
Hill, Sidney	1	1	0
Lake, Fred	1	1	0

MR. J. Y. FLETCHER'S COLLECTION.

Hermes, L.	2	2	0
Walker, E. O.	2	0	0

MR. J. Y. FLETCHER'S COLLECTION—(*cont.*).

	£	s.	d.
G.E.C. Manchester Office Staff, per Mr. F. G. Quance	2	0	6
Thames Paper Co.	10	0	0
Armstrong, M. F.	1	1	0
Black, A. S.	1	1	0
Fletcher, J. Y.	2	2	0
Boyd, G. A. E.	1	1	0

MR. V. F. HOLT'S COLLECTION.

Holt, Val. F.	1	1	0

MR. R. W. HUGHMAN'S COLLECTION.

"Electrical Times"	5	5	0
Hughman, R. W.	1	1	0
Round Table Club, per Guy Campbell	1	1	0
Wyld, W.	1	1	0
Davy, A.	0	10	6
Cousens, H. W.	5	5	0

MR. C. E. HUNTER'S COLLECTION.

Nettlefold & Sons	1	1	0
Asdell, J. H.	1	1	0
Raphael, F. C.	1	1	0
Child, J. S.	5	0	0
Elliott, J. W.	5	0	0
Caine, A. F.	1	1	0
Murphy, F.	1	1	0
Watson, W.	1	1	0
Hiatt, Dr. C. E.	1	0	0
Rimmer, E. G.	1	1	0
Read, T. S.	1	1	0
Fletcher, W. H.	1	1	0
Clark, W. B.	0	10	6
Jones, S. G.	1	1	0
Evans, H. J.	2	2	0
Ambler, A. P.	1	1	0
Miller, E. H.	1	1	0
Sells, J. R.	1	1	0
Rogers, S. R.	1	1	0
Newton, Russell C.	0	10	6

MR. S. D. WHITE'S COLLECTION.

Benjamin Electric Co. ...	10	10	0
Klaxon Co., Ltd.	3	3	0

MR. C. WILSON'S COLLECTION.

Driver, J. P.	1	1	0
Wilson, C.	5	5	0
Fairclough, T. M., & Sons, Ltd.	5	5	0
Strong, Allen & Co., Ltd. ...	2	2	0

The total amount collected (up to December 24th) in connection with the Annual Festival is £1,078 3s.

All persons who are or have been engaged in the electrical trade in the United Kingdom as employers, managers, teachers, or on the engineering, designing, drawing, sales or office staff, or in other similar capacities, are qualified to be members. Only those who have been members for at least five consecutive years are qualified to receive pensions.

The two main advantages of membership are: (*a*) Provision for oneself in the event of distress through ill-health, or other misfortune; seeing that there is now more than £10,000 invested, a member (or a member's widow or dependents) brought to such an unfortunate position is assured of the ability of the Institution to give adequate assistance. (*b*) Help for others; by becoming a member one assists towards giving temporary financial assistance to many who either are not qualified for pensions, or only require some financial assistance to tide over difficulties.

Membership carries with it voting powers, to be exercised when any application is made for a pension. The subscription of members is 10s. per annum, or such larger amount as each member is willing to give, and it may be paid in instalments. The payment of £10 in one sum constitutes the giver a Life Member, and of £100 a Life Governor.

Collecting books are issued for the purpose of enabling collectors to obtain votes as life subscribers or, if qualified, to secure membership of the Institution. Any person collecting in any year honorary contributions amounting to £10 10s. is eligible to be a life subscriber of the Institution with one vote for every £10 10s. so collected, without personal payment.

Copies of the rules of the Institution may be obtained free of charge upon application at the offices of the Institution, and subscriptions and donations are to be paid to the secretary, Mr. F. B. O. Hawes, 18 and 21, Park Mansions, Vauxhall Park, South Lambeth Road, London, S.W.

Commercial Travellers' Union.—The National Union of Commercial Travellers is holding a mass meeting at the Central Hall, Westminster, on January 8th, when the chair will be taken by Mr. G. R. Mason, the chairman of the Union. Among the speakers are to be the Right Hon. J. R. Clynes, M.P., and Miss Margaret Bondfield.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Generator Problem.

In reply to "Wireman's" letter, in your issue of December 17th, I presume the generator field was connected through a resistance to the 480-volt circuit. If so, has he tried the voltage across the shunt field, while the machine was running separately excited? If this voltage is less than that across the generator terminals, the machine will run self-exciting, provided the field connections and direction of rotation are correct.

The probable reason for the generator refusing to build up is that the shunt field was not correctly connected. Your correspondent should, therefore, reverse the shunt leads, and again try running the machine self-exciting. The polarity of the generator is determined by the residual magnetism in the iron, and will not be altered by the change of connections. If the machine builds up voltage, it will do so with the same polarity as when running separately excited.

The compound winding is for the purpose of regulating the voltage under varying loads. "Wireman" should satisfy himself that the connections are correct. When the generator is loaded and the series winding cut out or short-circuited, the voltage across the machine terminals should be less than when the set is sustaining the same load with the series winding in commission.

T. A. Robertson.

Glasgow.
December 27th, 1920.

I have read with interest the correspondence by "Wireman," under this heading, and am of the opinion that the generator in question is designed for separate excitation. In many of these small sets, both for kinematograph and electric welding purposes, it is customary to excite the generator shunt field at the motor line voltage, the connections between the two machines being left "open" to enable a shunt regulator to be inserted. A comparison between the resistances of the shunt circuits of the machines would reveal if this were the case or not in the instance quoted.

C. A. Besley.

Cardiff.

German Competition in the Electrical Trades.

Your correspondent "W. H. M." overlooks the fact that next to hard work on the part of the producer, it is *quantity* which cheapens the cost of all manufactures and so enables the home buyer to have cheap goods, and, at the same time, enables the manufacturer to compete successfully in the world's markets.

Without a secured home market, free from dumped goods, no manufacturer can successfully lay himself out for this quantity production.

We wonder if "W. H. M.," when he meets the daily processions of the unemployed, tells them not to "whine," but to thank Heaven that the German goods in the shops they pass in their weary march are helping Germany to pay her war debts. But is "W. H. M." so simple as to think that the wily Hun really intends to pay his war debts, whether we trade with him or not? We have had several offers of German electrical machinery, but we would not touch them with the end of a barge pole, and we should like to thank you, if we may, for your splendid "Leader."

One of our latest callers was an international Jew representative of a German firm of motor manufacturers, his card bearing an address at Rotterdam. The real address of the firm is in Rhenish Prussia, and we believe they had no office in Rotterdam before the war.

E. P. Allam & Co.
(E. P. Allam).

London.
December 24th, 1920.

An Engineers' Club for London.

I once had an experience in connection with the formation of a club in the Far East which may not be without interest in this case. The premises for this club existed; a special committee appointed to go into the question reported unanimously in favour of a club, but nevertheless agreed that they could find no way of guaranteeing its financial success, and therefore were unable to recommend that the matter be proceeded with, as a sufficient number of guarantors did not appear to be forthcoming. The idea would, therefore, have lapsed, but a counter suggestion was made of placing the premises at the disposal of one of the leading caterers in the town at a nominal rental, and allowing him to charge at schedule rates for meals, refreshments, &c. The catering firm undertook to do this, and accepted entire financial responsibility, they themselves also undertaking to complete the furnishing of the premises, supply periodicals, and give the usual facilities.

The club was an immediate and unqualified success, both financially and otherwise, being run economically on first-class lines as a business proposition, without the committee or the members incurring any financial responsibility. A point of importance was that the club subscription was very small indeed, in fact merely nominal, in order that it might be used very freely, but it should be stated that the membership was confined to certain qualified persons who, because of their interests, desired to meet socially in a club.

Ernest T. Williams.

London.
December 23rd, 1920.

The Cost of Living in India.

With reference to a letter in your issue of November 5th, from "M.I.E.E.," making inquiries as to the cost of living in India, I should be always glad to give members of the I.E.E. all the information in my power on this subject, if they will communicate with me. I should always be pleased to give advice of any kind to any members proceeding to India.

C. C. T. Eastgate,
Hon. Sec. I.E.E. for India.

Electrical Engineer's Office, Lahore.
December 4th, 1920.

[We are greatly indebted to Mr. Eastgate for this offer, and tender thanks to him on behalf of our readers.—Eds. Elec. Rev.]

Shop Displays.

The letters appearing in your "Correspondence" columns under "Shop Displays," and written by "The Retailer" and "Injured," must be interesting to a degree to hundreds of electrical contractors throughout the country.

I likewise would welcome a real *Union* of Contractors, being convinced from experience of the absolute uselessness of the E.C.A. as at present constituted. Their various committees all consist of the same men who do little or nothing to remedy the all too numerous evils complained of by "Retailer" and "Injured." It is in fact a non-representative body comparable but considerably inferior to the House of Lords.

I have been a member of the three Associations known as the National Federated Electrical Association, of which E.C.A. is a component part, and have given it what I consider a very fair trial, and up to a certain period attended almost every meeting to which I was called, and further taken some trouble to raise my voice and bring to the notice of this body not alone the matters referred to by your two writers but matters even more vital to the interests of the contractor, but have met with utter failure to impress them with the importance of matters.

In one particular instance did they excel in muddling, viz., the rights of electricity suppliers to charge for service mains, and in consequence of this my firm were hopelessly misled, together with numerous clients. A so-called subsidy scheme is put into force which the rank and file of the members, I venture to suggest, never understood, and to my mind is an imposition favourable only to a possible minority.

In conclusion, I should be willing to assist "The Retailer" and possibly "Injured" to call a meeting to fully discuss matters in general, and I am confident if it be properly advertised a large hall will be necessary to accommodate those interested.

I should add that I resigned from N.E.C.T.A. about two months ago, and my resignation has been accepted.

May a real Union of Contractors be the result of our efforts united in all its undertakings, and in the words of our Prince, "pull together," which is quite impossible with the present organisation.

For and on behalf of
Watson, Marsh & Co. (Hampstead), Ltd.
M. Cohen, *Managing Director.*

London.
December 23rd, 1920.

I entirely agree with the letter of Mr. Marshall Carr in your issue of December 24th, as to the necessary action of the Electrical Contractors' Association, but when he assumes that that action is not already taking place, and says that it now remains for the E.C.A. to justify its existence or leave it to him and his friends to start a new organisation, it becomes very evident that he is almost in entire ignorance as to the activities of the E.C.A. and its trade association, N.E.C.T.A., Ltd. Mr. Carr enumerates four chief points. Taking these seriatim, the replies are as follows:—

1. *Registration of Electrical Contractors.*—A very strong move was made by the E.C.A. in this direction immediately on the conclusion of war, in addition to a preliminary move during 1917. In 1919, the Board of Trade received a deputation on the matter, and expressed full sympathy, but regretted that registration was at that time not possible. Further action in the matter is already being vigorously developed by the E.C.A.

2. *Negotiations with Manufacturers and Wholesale Houses.*—These have been in progress for years. Agreements in cer-

tain instances are already in existence, and others are still under negotiation. Other very effective action is fully described in the Editorial of the *Electrical Contractor* for December, 1920 (price 2d.).

3. *Appeal to Users to deal only with Registered Contractors.*—It will be obvious that this must wait until contractors are registered.

4. *The Association to combine in making a Dead Set against Firms offering Trade Terms to all and sundry.*—Mr. Carr will find this combination already exists in N.E.C.T.A., Ltd., and that very great progress has been and is being made.

It appears, therefore, that the Association which Mr. Carr desires, and the action which he considers such an association should take, are already in existence, and all that remains is for him and others like him to become acquainted with its work, take up membership, and give all the assistance they can.

H. J. Cash,
Past President E.C.A. and N.E.C.T.A., Ltd.

Westminster.
December 24th, 1920.

A Curious Phenomenon.

It seems likely from Mr. Hassall's letter that the gas burners are sensitive to certain sounds, especially high notes, the flame shortening and becoming more noisy when such sounds occur in the neighbourhood. If this is the cause, probably a bunch of keys shaken near the burners will produce the same effect. Altering the air supply to the burners may perhaps reduce it, but some burners are quite incurable. I once had a small laboratory burner which could not be used, because the flame invariably went quietly out if any high note happened to be produced in the room.

T. H. Muras.

London.

I should be interested to know whether your correspondent has actually tested the gas pressure referred to, and also would advise him to wedge the hammers of the bells in question, and then note whether there is an increase in gas pressure. I think he will find that the above phenomenon is due to sound waves, and not to any electrical conditions. I shall be interested to know the result.

E. Rothwell.

Rochdale.
December 17th, 1920.

Information Wanted.

Can you or any of your readers recommend me some text-book or technical articles dealing with the design of contactors for motor starting for A.C. and D.C. service?

Electricus.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

35,019. "Electric fuse-boards." R. W. Bill. December 13th.
35,026. "Electric ceiling-rose." S. E. Foster and T. Grocott. December 13th.
35,036. "Electrical connectors." W. J. Davis. December 13th.
35,047. "Automatic electric switch." C. Donovan. December 13th.
35,066. "Apparatus for measuring temperature of windings in electrical machines, &c." Akt. Ges. Brown, Boveri et Cie. December 13th. (Switzerland, December 12th, 1919.)
35,084. "Electric-lamp sockets and switch devices." A. J. H. Gurney. December 13th.
35,086. "Dynamo-electric machines." W. B. Sayers. December 13th.
35,109/10.—"Electric signalling-lamps." D. T. Tritsch. December 14th.
35,111. "Electric heaters." H. B. Butler and C. Joyner & Co. December 14th.
35,164. "Sound amplifiers." W. Lyons and J. M. Masterson. December 14th.
35,175. "Safety fuses for electric circuits." E. Antinoro. December 14th.
35,188. "Electric winch." J. Boost et Fils Soc. Anon. December 14th. (Switzerland, March 1st, 1919.)
35,192. "Control of high-frequency electrical oscillations." C. F. Elwell and J. Mamlok. December 14th.
35,195. "Electrical motor starting systems." Metropolitan-Vickers Electrical Co. December 14th. (U.S., June 3rd.)
35,199. "Electric geysers." C. F. Peters. December 14th. (Germany, May 7th.)
35,213. "Means for jointing submarine electric cables." W. T. Henley's Telegraph Works Co. and E. E. Judge. December 14th.
35,225. "Thermionic valves." A. F. Sykes. December 14th.
35,303. "Liquid, &c., electric controllers and/or starters for electric motors." A. West and A. West & Co. December 15th.
35,308. "Process for feeding electric traction lines supplied with direct current." E. Sorelli. December 15th. (Italy, December 15th, 1919.)
35,316. "Telephone exchange systems." Western Electric Co. (Western Electric Co.). December 15th.
35,319. "Manufacture of electrodes of large cross-section." Ges. für Teerverwertung. December 15th. (Germany, November 27th, 1919.)
35,323. "Spark plugs." Champion Ignition Co. December 15th. (U.S., March 8th.)
35,324. "Spark-plug electrode." Champion Ignition Co. December 15th. (U.S., August 14th.)
35,329. "Driving mechanism for hand-operated magneto generators." E. A. Angold and A. H. Railing. December 15th.
35,336. "Wireless transmitting stations." H. J. Round. December 15th.
35,337. "Aerial systems for wireless telegraphy and telephony." C. S. Franklin. December 15th.
35,338. "Duplex telegraphy and telephony." Soc Francaise Radio-Electrique. December 15th. (France, January 16th.)
35,340. "Electric coupling devices." S. E. Smith. December 15th.
35,352. "Cord-grips for electrical apparatus." A. Kirk and R. C. Milliken. December 15th.
35,360. "Galvanic battery containers." Sir C. S. Forbes & Lyto, Ltd. December 15th.
35,364. "Long-distance transmission." A. M. Taylor. December 16th.
35,378. "Dynamos for motor-cycles, &c." E. Hallowell. December 16th.
35,380. "Arrangements for indicating position of apparatus or conditions of circuits at a distance." Automatic Telephone Manufacturing Co., J. R. Beard, Electrical Improvements, Ltd., and A. E. Hudd. December 16th.
35,391. "Electric heaters." H. B. Butler and C. Joyner & Co. December 16th.
35,392. "Electric heaters." E. W. N. May and May & Padmore. December 16th.
35,400. "Spherical spark-plugs." E. C. Kahn. December 16th.
35,408. "Thermionic tubes or valves." A. A. C. Swinton. December 16th.
35,418. "Electric meters." Fabriques des Montres Zenith Successuer de G. Favre-Jacot et Cie. December 16th. (Switzerland, August 5th, 1915.)
35,430. "Plug and socket connections for electric cables." J. Mirrey and A. Reyrolle & Co. December 16th.
35,434. "Signalling devices." W. Jepson. December 16th.
35,436. "Electric accumulators." H. Leitner. December 16th.
35,438. "Safety controlling gear for electrically-propelled vehicles." R. Garrett & Sons and A. J. Serve. December 16th.
35,445. "Electrically-wound clock." E. E. Graig. December 16th.
35,446. "Electric burglar and fire alarms." E. H. Bock. December 16th.
35,458. "Electric stoppage, railway station, &c., indicators." L. Fontana, V. Fontana, and E. di Pietro. December 16th.
35,464. "Thermionic valves for wireless telegraphy and telephony." T. E. Goldup, B. Hodgson and L. G. Preston. December 16th.
35,469. "Supporting currents of different frequencies upon existing alternating-current systems." A. M. Taylor. December 17th.
35,486. "Machines for popping barley by electrical methods." A. Crossley. December 17th.
35,498. "Electric lamps." C. E. P. Gabriel. December 17th.
35,510. "Insulation of electric cables." C. J. Beaver and E. A. Claremont. December 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

2,639. "Methods of and means for amplifying electrical variations." British Thomson-Houston Co. (General Electric Co.). February 22nd, 1916. (154,232.)

1919.

13,328. "Radio-signalling systems." British Thomson-Houston Co. (General Electric Co.). May 27th, 1919. (154,247.)
16,125. "Methods of and apparatus for manufacturing electric incandescent lamps. British Thomson-Houston Co. (General Electric Co.). June 26th, 1919. (154,258.)
18,411. "Dynamo-electric machinery." T. L. R. Cooper. July 24th, 1919. (Cognate application 20,544/19.) (154,271.)
20,193. "Motor, particularly applicable to railway signalling." Automatic Telephone Manufacturing Co. and A. E. Hudd. August 16th, 1919. (Cognate application 30,314/19.) (154,286.)
20,279. "Dynamo-electric machinery." Lo Thermo Patents, Ltd., and J. W. Burleigh. August 18th, 1919. (154,290.)
20,426. "Direction communicating systems for guns, searchlights, range-finders, torpedo tubes, and other apparatus." G. M. Newbury and Evershed & Vignoles. August 19th, 1919. (154,293.)
20,478. "Device for securing electric cables and the like to walls and other supports." G. H. Scholes and E. A. Claremont. August 20th, 1919. (154,295.)
20,518. "Electric furnace for the continuous heating of rivets." A. Imbery. August 21st, 1919. (154,300.)
20,548. "Electric signalling systems, especially applicable to combined telegraph and telephone systems." Western Electric Co. (Western Electric Co.). August 21st, 1919. (154,303.)
20,612. "Memorandum devices for use in connection with telephones and other purposes." J. M. Hattersley. August 22nd, 1919. (154,312.)
20,628. "Telegraph printing systems." Automatic Telephone Manufacturing Co., H. H. Harrison, and S. R. Smith. August 22nd, 1919. (Cognate application 25,369/19.) (154,313.)
20,855. "Hooks for electro-plating." O. Roedel. September 4th, 1918. (132,244.)
21,334. "Electric storage batteries." E. R. Royston (Federal Storage Battery Co.). August 30th, 1919. (154,343.)
21,448. "Method and apparatus for detecting distant ships whereon dynamo-electric machinery or the like is running." Q. C. A. Craufurd and L. O. Doughty-Wylie. September 1st, 1919. (154,347.)
21,497. "Method of varying the electric current passing through electro-magnets or solenoids in automatic musical instruments or players causing different degrees of loudness in the note played." H. R. Kidner. September 2nd, 1919. (154,348.)
21,783. "Push-button controls of electric motor-starters." Igranic Electric Co. and A. H. Mackley. September 4th, 1919. (154,360.)
22,039. "Thermionic devices." J. Scott-Taggart. September 8th, 1919. (154,364.)
23,118. "Electric condensers." F. G. Goldstone and S. Brydon. September 19th, 1919. (154,386.)
23,586. "Electric fuses." F. A. Ross. September 25th, 1919. (Patent of addition not granted.) (154,390.)
28,006. "Electrically-operated diaphragm horns." W. P. Thompson (L. Chollet). November 12th, 1919. (157,432.)
29,414. "Electric furnaces." A. M. Erichsen. November 25th, 1919. (154,444.)
30,494. "Thermo-electric couples." C. E. Foster. December 5th, 1919. (154,454.)
32,853. "Method for electrolysing a solution of nickel salt." C. Heberlein. August 8th, 1919. (Divided application on 141,766.) (154,471.)

1920.

3,000. "Telephonic transmission by high-frequency currents." L. N. Brillouin. January 31st, 1919. (138,610.)
4,991. "Magneto-electric machines." G. M. Turner. February 19th, 1920. (154,492.)
6,445. "Means in connection with carburettors for electrically heating the induction charge for internal-combustion engines." R. H. Ames. March 3rd, 1920. (154,499.)
7,503. "Electric controlling switches." P. H. Pudumjee. March 12th, 1920. (154,503.)
12,146. "Electric valves or safety devices for the discharge of excess potentials." G. Giles. May 1st, 1920. (154,509.)
14,604. "Short-circuit terminals for the magneto-ignition apparatus of internal-combustion engines." Scintilla. May 28th, 1919. (143,916.)
16,457. "Brush-gear for dynamo-electric machines." J. Stone & Co. February 16th, 1917. (145,429.)
17,132. "Electric current interrupters." C. E. Bennett. June 24th, 1919. (146,279.)
18,018. "Electrical switch operated by a current of air." F. Krupp Akt. Ges. December 27th, 1918. (145,720.)
18,726. "Means for connecting together sets of electrical conductors." H. A. Whitehead and J. M. Whitefield. July 5th, 1920. (154,518.)

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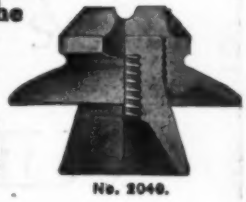

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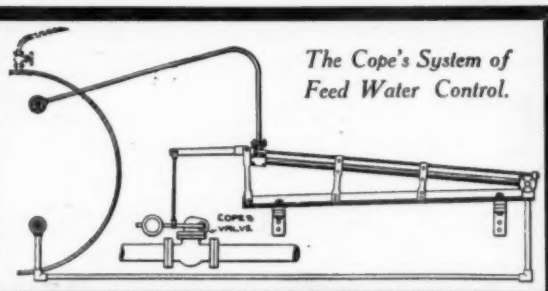

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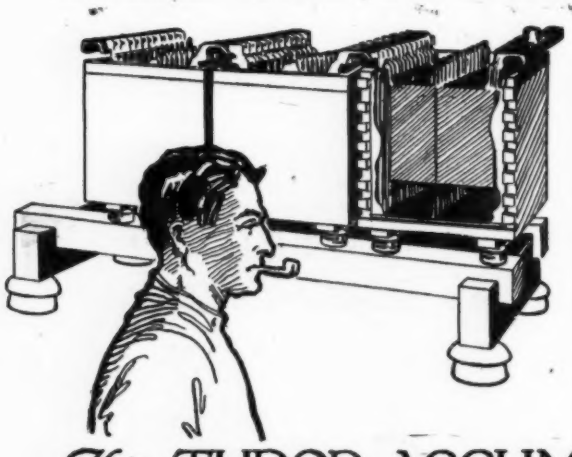

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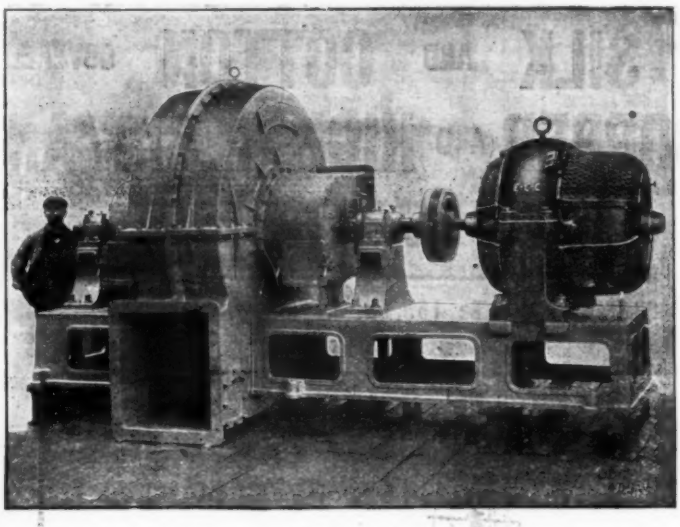

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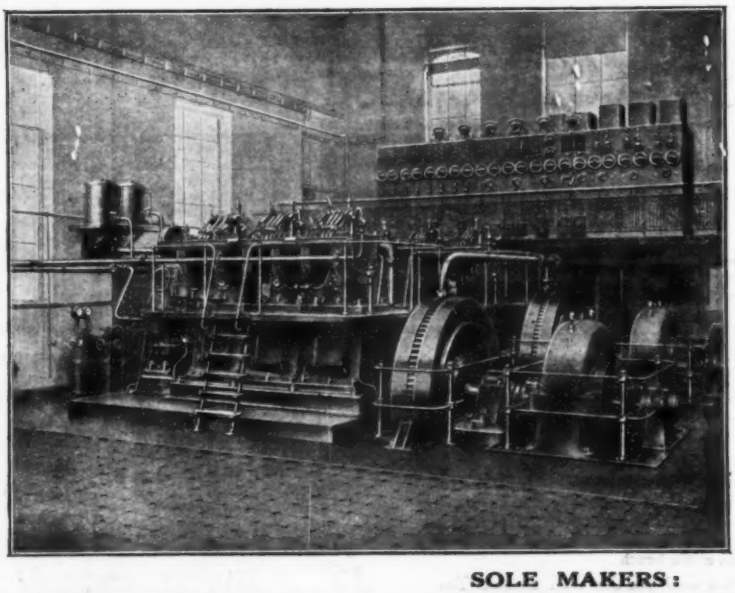

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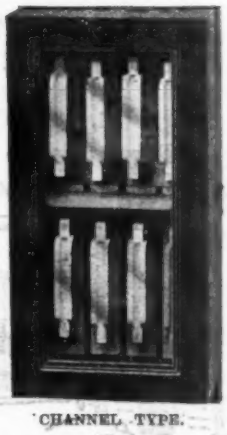

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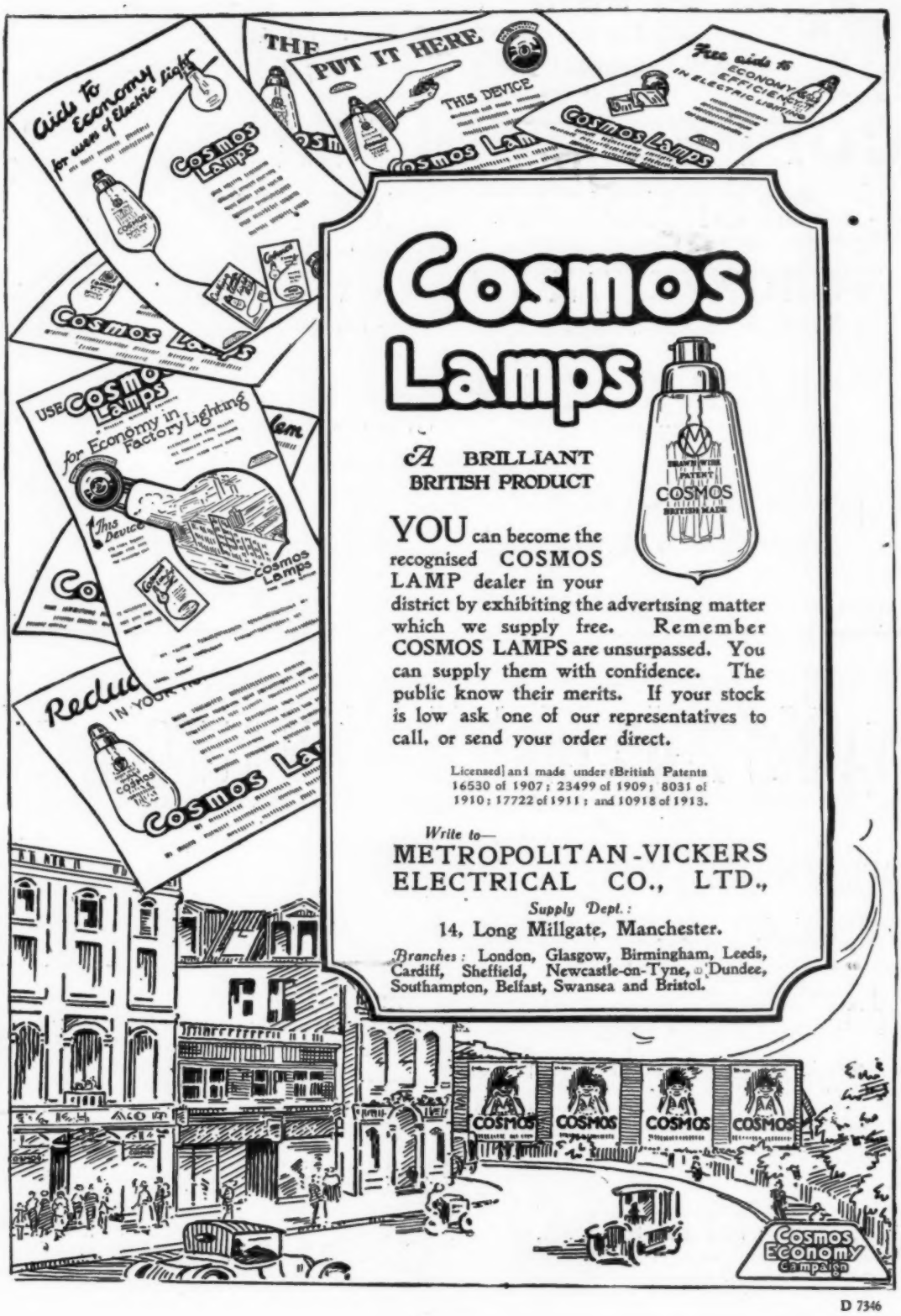
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YOU can become the recognised COSMOS LAMP dealer in your district by exhibiting the advertising matter which we supply free. Remember COSMOS LAMPS are unsurpassed. You can supply them with confidence. The public know their merits. If your stock is low ask one of our representatives to call, or send your order direct.

Licensed] and made under [British Patents 16530 of 1907; 23499 of 1909; 8031 of 1910; 17722 of 1911; and 10918 of 1913.

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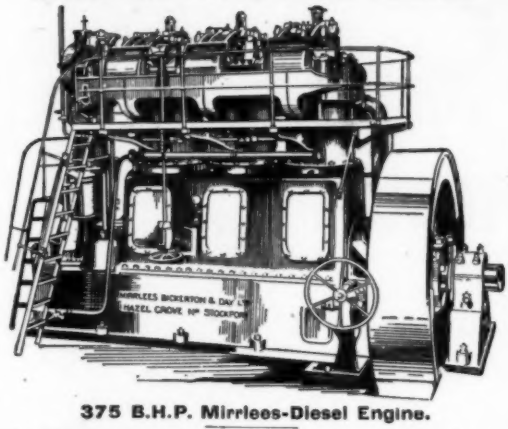
British Made.

Best and most reliable for Electricity Works and Private Power Stations.



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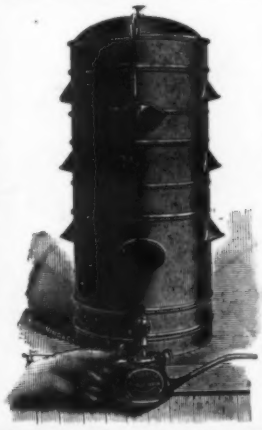

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Featherweight Type, with Ball Bearings, $\frac{1}{100}$ H.P. up to $\frac{1}{8}$ H.P.

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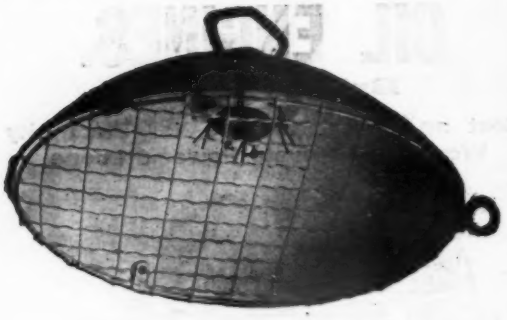

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As supplied to the Principal Ship-builders and Steamship Owners.

Universally copied but never equalled or excelled.

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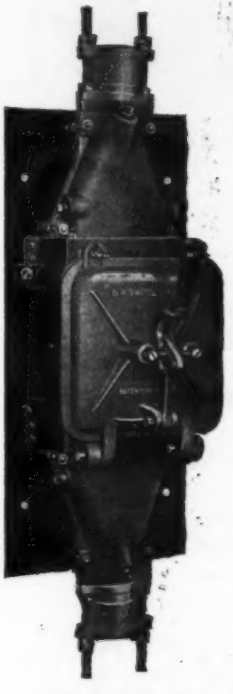
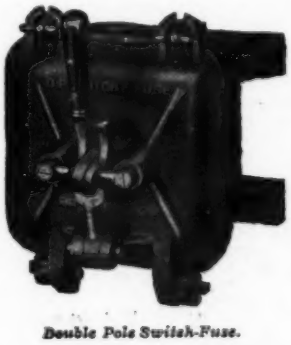
THE *Mark of* EMC *Efficiency.*



Double Pole Switch-Fuse.



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This is Our IRONCLAD SWITCH

It has satisfied the demand for a thoroughly reliable article for many years.

Copies more or less complete have been recently advertised under other names, but

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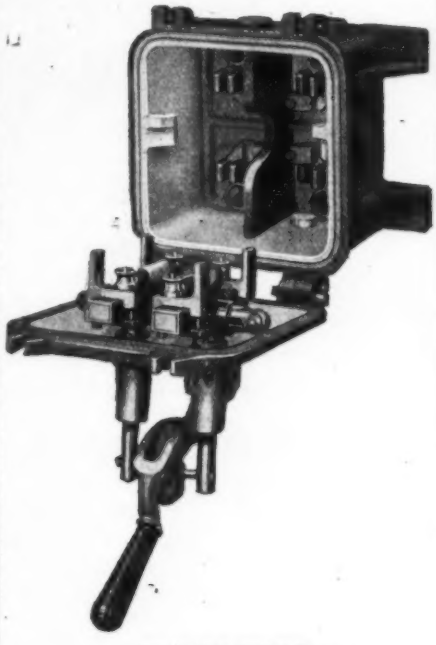

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SUNCO ELECTRIC FIRE. Adams Model. 3-KW. loading. Supplied in Best Glazed Black Enamel and Armour Bright Finishes.

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Are you taking advantage of this increasing demand? Sunco Electric Fire Stockists are provided with free advertising literature in many attractive forms, including booklets, show cards, post card, window slips, &c.

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Sunco Electric Fires enable you to offer your customers electric fires which give intense radiant and satisfying heat and which are an attractive addition to the furnishing of any room.

The elements are robust, have a long useful life and are fitted into cases of excellent design and workmanship. The range of models that can be delivered from stock is extensive. Every model is distinctive and original.

Write to-day for List No. 315, which gives full particulars of Sunco Electric Fires and advantageous terms to dealers.

Telephone: Gerrard 7766 (4 lines).

The SUN ELECTRICAL COMPANY LIMITED
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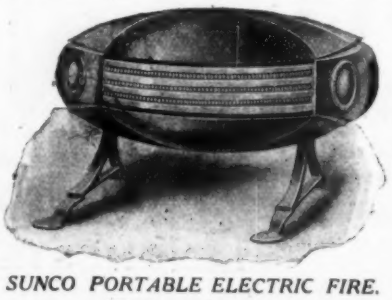

SUNCO PORTABLE ELECTRIC FIRE. Weighing only 6¼ lbs.

Best for Local Heating

This Sunco Fire can easily be carried from room to room and proves invaluable for intermittent local heating. Consuming half a unit per hour, it can, in most cases, be used on lighting circuit if required. List No. H 3000 is finished in Glossy Black Enamel with Antique Copper Ornaments, Wire Guard, Handle, and Two Yards of Flexible Cord.

39/- *subject.*

Nineteen-twenty

It has passed—with all its surprises, all its disappointments, all its problems—passed into the realm of "things that have been." And its passage has been marked more by rejoicings at the entrance of its successor than by evidence of grief over its own departure.

Nevertheless a review of its record is, both individually and nationally, an essential duty. In our own case, as part of such duty, we shall shortly render to our shareholders an account of our stewardship, but we have always felt that no less is due to our customers, and that they, too, should be provided with a statement as to our treatment of the interests which they have entrusted to our care.

RUBBER INSULATED CABLES.—All arrears have been wiped off. Large stocks have been built up at our Works and Branches, which our customers in each centre are asked to consider as their own. We will deliver one coil or 100 direct to the job on receipt of a telephone message.

PAPER INSULATED CABLES.—Deliveries as in pre-war times are now the rule, and this notwithstanding a demand many times greater than existed then.

MINING CABLES.—The most sensational industrial upheavel of the year caused little or no interruption in demand—rather the reverse, proving that Mine Owners were never in doubt as to the ultimate solution of the output problem. Our Works have been and are still very heavily booked up in this class of Cable, but the extensions we have made are enabling us to meet all demands with reasonable promptitude.

J. & P. HOUSE WIRING SYSTEM.—1920 saw the introduction of the J. & P. House Wiring System, but no one seeing our order books for the later months would suspect this, so immediately have its outstanding merits secured recognition on all sides. Only the exceptional measures taken to ensure "Mass Production" have enabled us to avoid disappointing our customers. So far we have let no one down, but the demand is growing at such a cumulative pace that we would ask our friends to discuss their needs well in advance.

SWITCHGEAR, INSTRUMENTS, &c.—The after effects of the Iron Moulders' Strike—a severe handicap until practically the last weeks of the year—were mainly responsible for delay in clearing off arrears. Our books are still very full of orders, but none of these are now of old date and we hope to be able to keep abreast of the demand. New designs have been developed and put on the market to meet the continuous rise in Transmission pressures.

TRANSFORMERS.—Notwithstanding the extensions we have made, and our progress in the matter of production, we have still to appear in a white sheet as regards the delivery position in this department. During all the year orders booked have been in excess of output. Naturally the only solution is to increase the latter and still further extensions, with this purpose in view, are in hand. In the meantime we can only ask our customers' indulgence and assure them that no blind sequence of rotation is being observed, but that we are doing our utmost to deal with the work in the actual order or urgency.

EXPORT BUSINESS.—We have always recognised the great National and individual importance of Export Work, and during 1920 we have not only recaptured the leeway lost during the War period, but have left our previous records far behind. A new branch has been opened in Sydney to deal with Australian business, and has met with immediate and gratifying success.

So much for 1920—May 1921 provide for us an even better record—for our customers' success beyond anticipation and—for the Nation, peace, progress and prosperity.

JOHNSON & PHILLIPS Ltd., Charlton, LONDON, S.E. 7.

City Office: 12, Union Court, Old Broad Street, E.C. 2.

ELECTRICAL ENGINEERS & CABLE MAKERS

Electric Vacuum Cleaners

"The Apex."

Latest Model.

Large Stocks.

An Investment for any Home.

32 Volts to 250 Volts.

∴ ∴ *Enhance your Reputation* by supplying Vacuum Cleaners ∴ ∴ of Proved Merit.

These two types are Real Sellers and are Fully Guaranteed.

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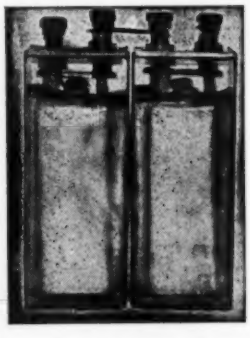
"The Econo."
Stocked in Two Sizes.

A Carefully Designed, Solidly Constructed, Fully Guaranteed Vacuum Cleaner.

50 to 250 volts.

Prices with Pleasure.



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SURPLUS GOVERNMENT STOCK. ABSOLUTELY NEW.

CONSIDERABLY BELOW COST.

Only a limited quantity of our original stock of 26,400 left. Send your enquiries before it is too late. This offer cannot be repeated when present stock is sold. Unobtainable elsewhere at our price.

These Accumulators have no plates to buckle. Internal short-circuiting is impossible. Will hold their charge for months.

LIBERAL DISCOUNT TO THE TRADE.

4-volt, 20 amp.-hour (actual). Celluloid cases only.

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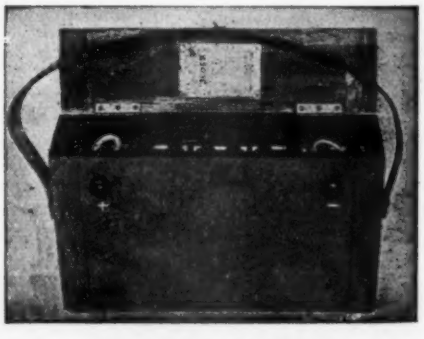
And most of the Leading Houses in the Electrical Trades

6-volt, 20 amp.-hour (actual). Supplied with or without Teak Outer Cases.

"The Autocar," July 24th, 1920, gave an unsolicited article, referring to our remarkable offer to supply the finest Accumulator on the market at a price unheard of before, and recommended owners of cars, who are desirous of equipping their cars with an efficient lighting set at a bargain price, to communicate with us at once. A detailed and instructive scheme of wiring these cells in parallel, together with diagram, was given. We have had this article reprinted.

LET US SEND YOU A COPY.

The 6-volt and 12-volt sets are supplied with strong Teak Cases, fitted with outside terminals (as per illustration), brass hinges and fastener, and solid leather straps.



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PENDULUM INDICATORS

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We keep a stock at your disposal, and will send, by Parcel Post—
SAME DAY AS ORDER RECEIVED—any size indicator up to 12 signals, suitably **PACKED** and **INSURED** against loss or breakages. Larger sizes as usual.

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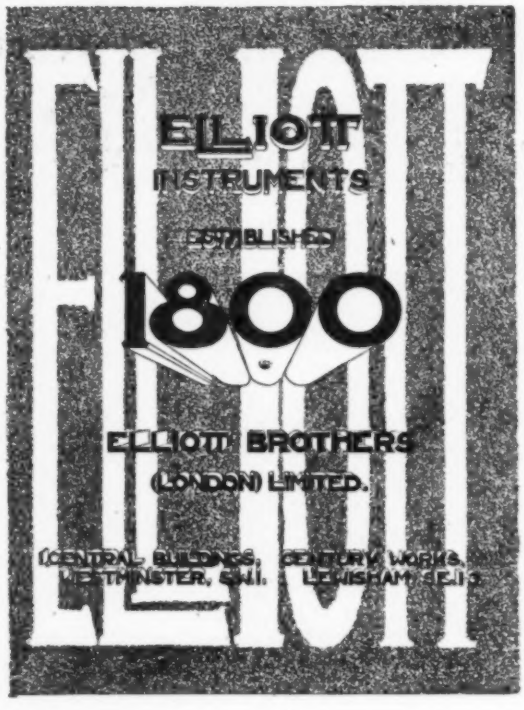

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They save space too, but let us send you full particulars of their advantages and proof of their satisfactory service.

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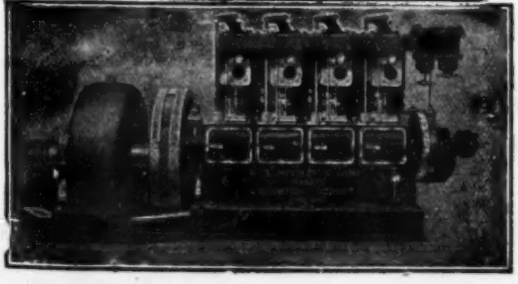
For direct coupling to generators and made in units from 10 to 350 B.H.P.



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POWER TRANSMISSION APPLIANCES.

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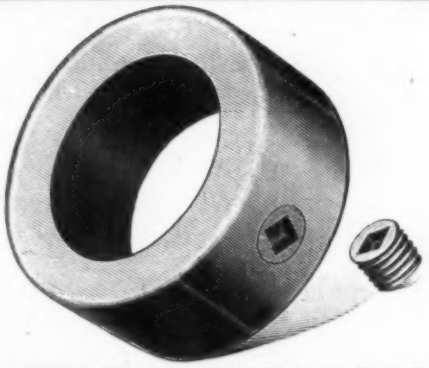

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For HOUSE LIGHTING, Etc.

GOOD DELIVERIES

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ACCUMULATORS - SOLID - NO PLATES.

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The Block Cell will hold its charge for a much longer period than the ordinary accumulator, and can be left standing for months. It contains no plates, and is, therefore immune from the inherent weaknesses of Plate Cells. For house lighting purposes it is particularly suitable for capacities up to 200-amp. hours

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HIGH STARTING TORQUE—
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LOW STARTING CURRENT—
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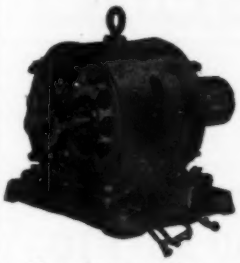
QUICK ACCELERATION—
—2 to 15 seconds under load—

THE BRUSHES DO NOT TOUCH
the commutator after full speed is reached.



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Four points to consider when you are selecting a standard.

Manufactured only by

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TRADE MARK.

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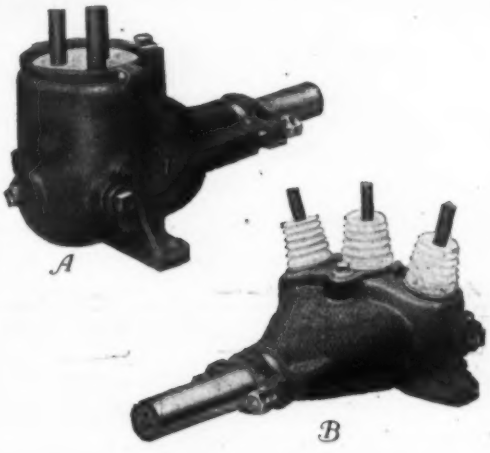

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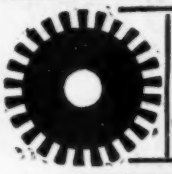

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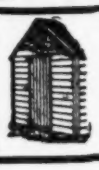

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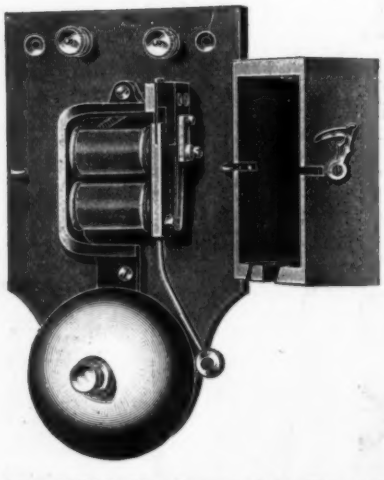

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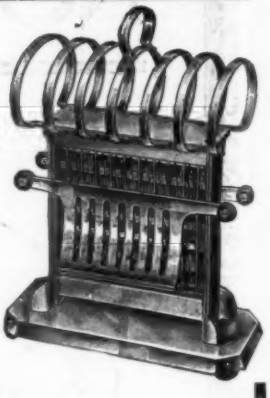

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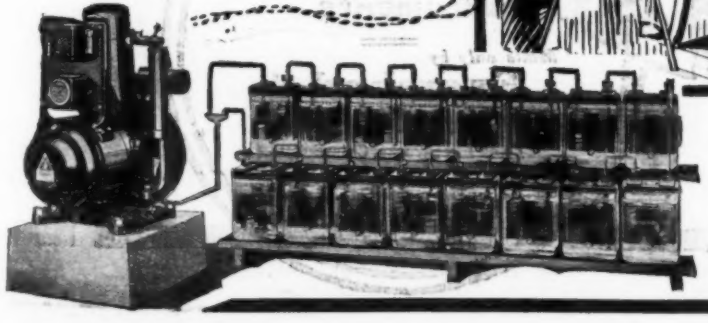

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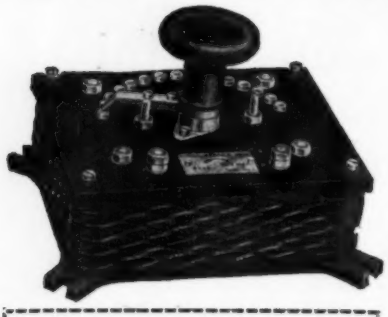

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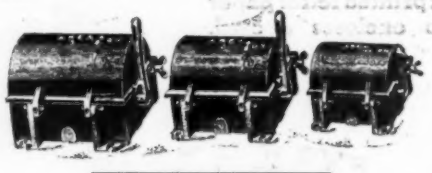

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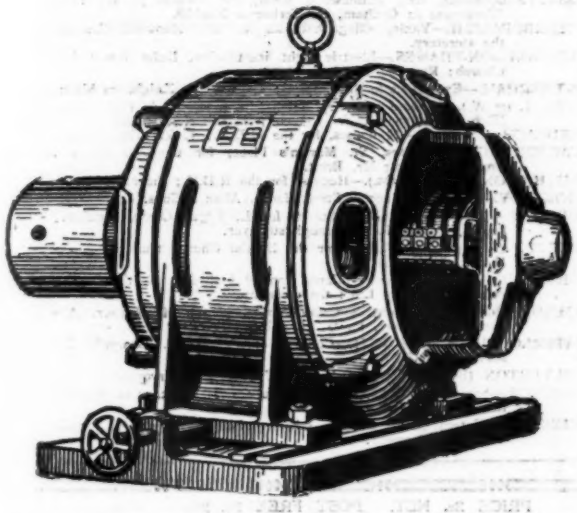

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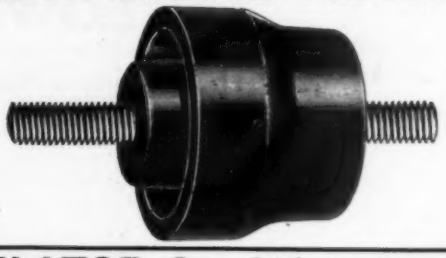

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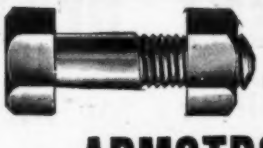

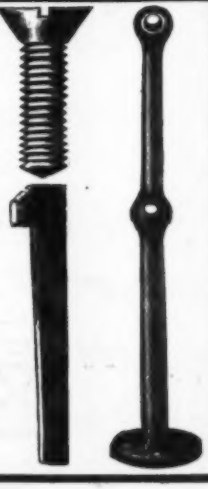

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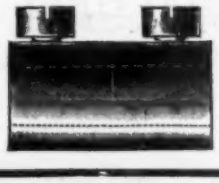

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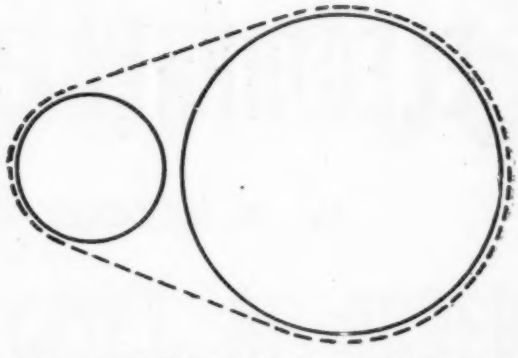
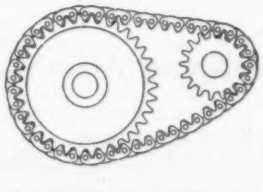
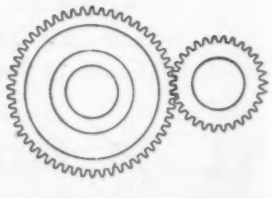


At centre distances too short for belts, chain drives have a maintained efficiency against the decreasing efficiency of Gears.



Multi-tooth engagement of chain on wheel, efficiency not decreased by wear.



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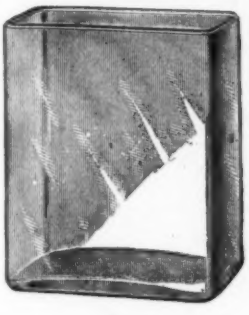

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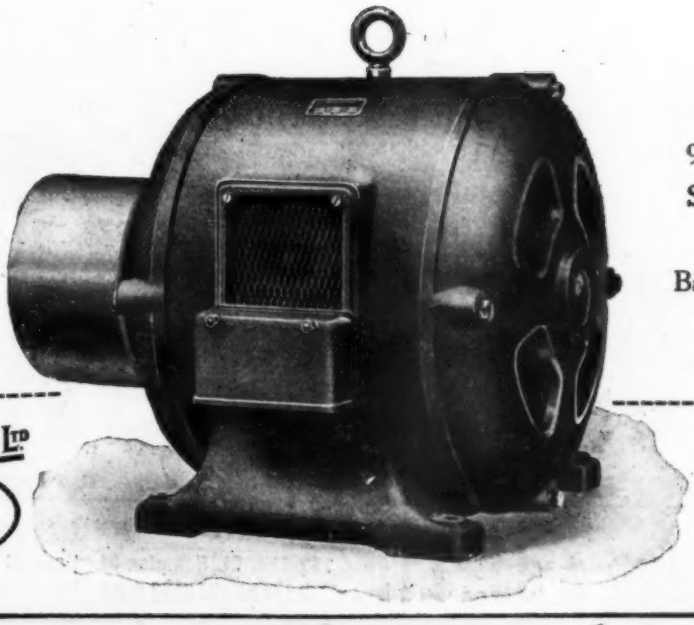

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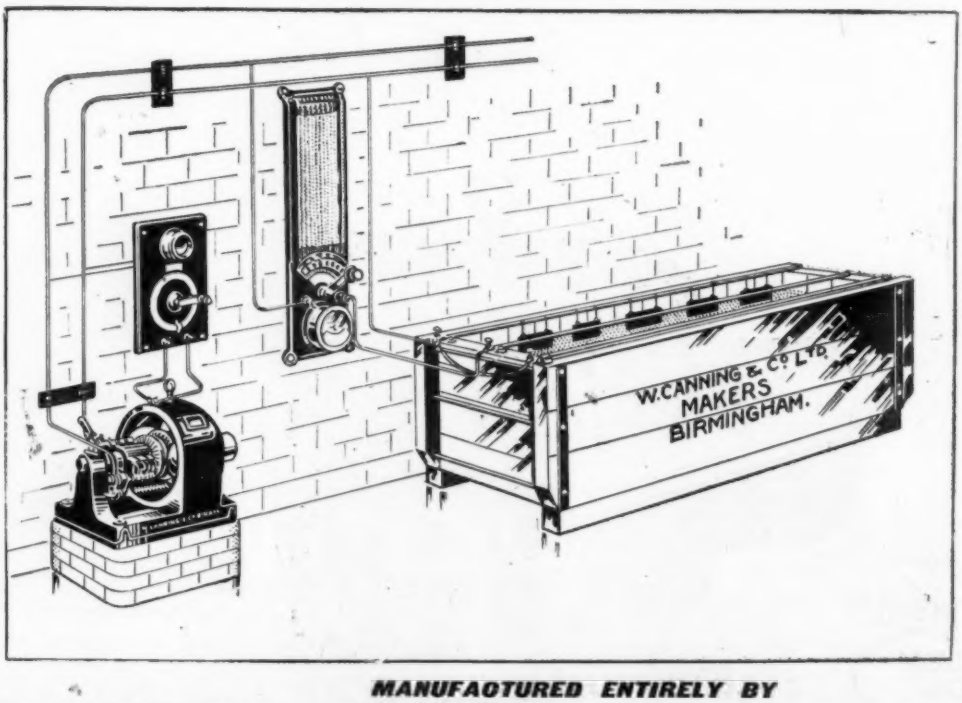

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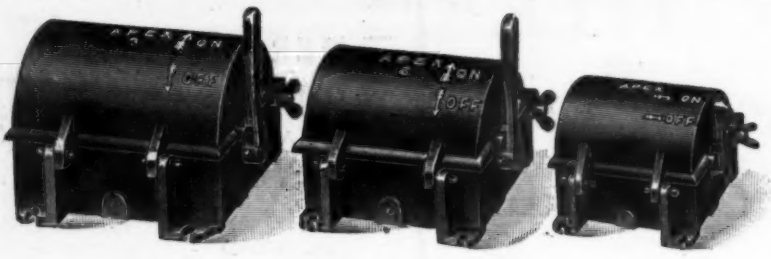

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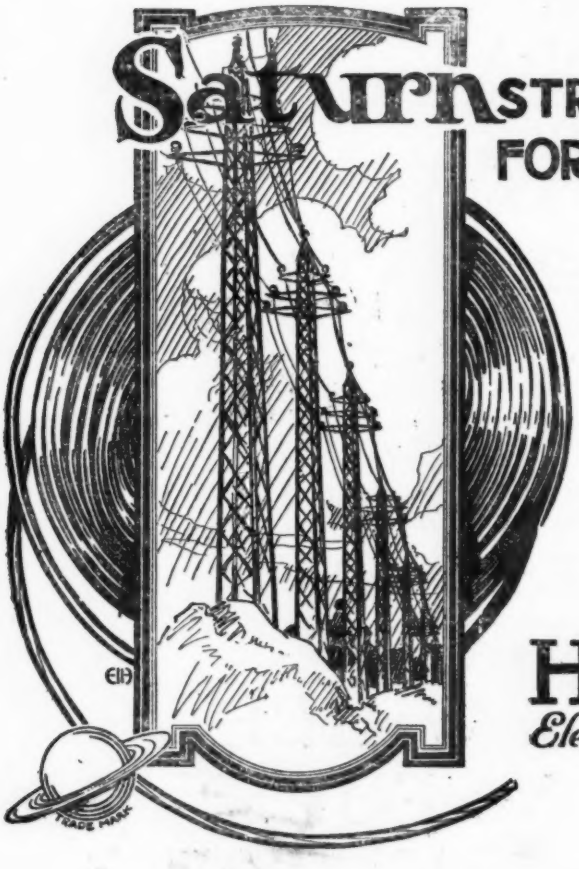

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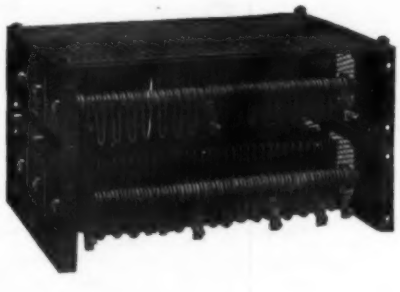

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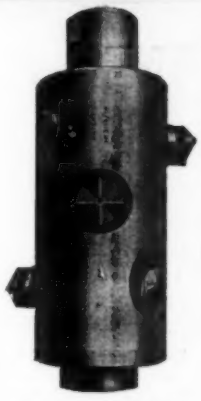

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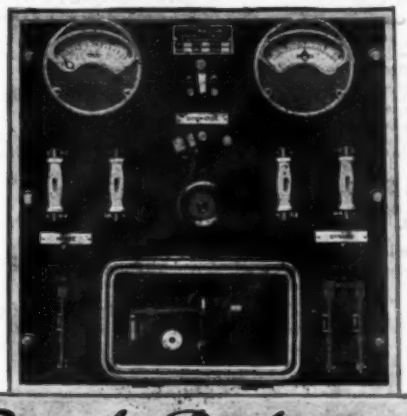

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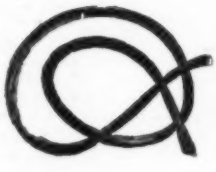
L.P.S.  **Insulating Tubing.**

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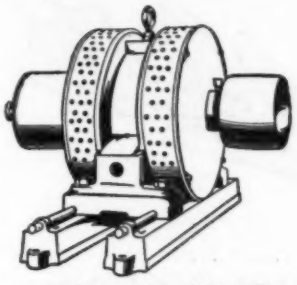

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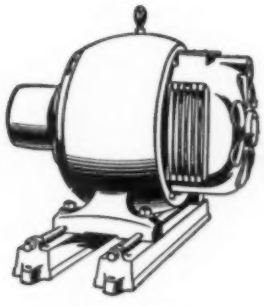

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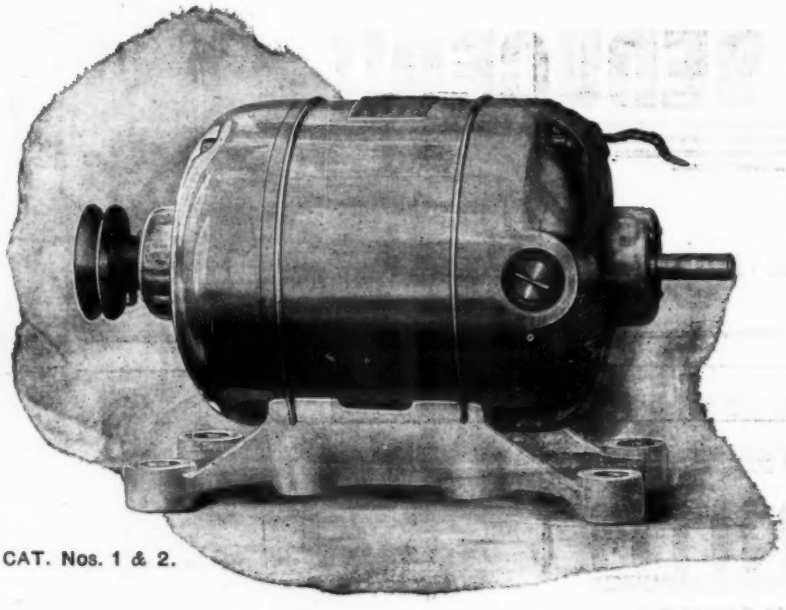

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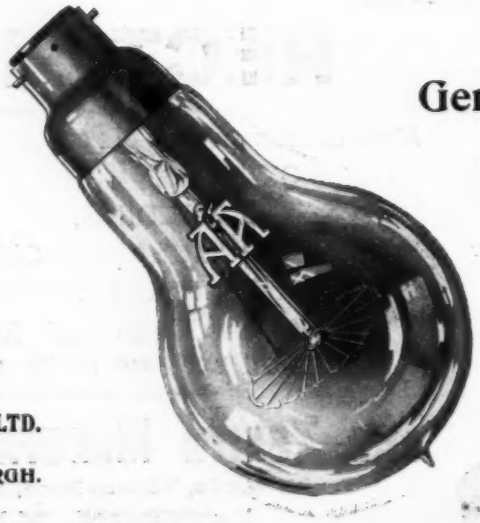

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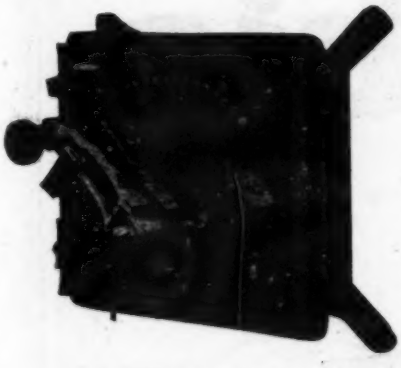

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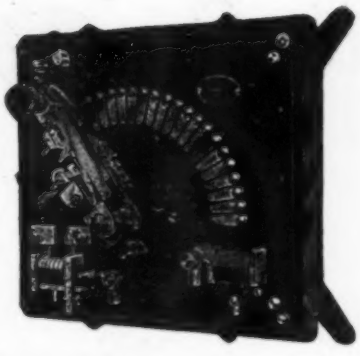

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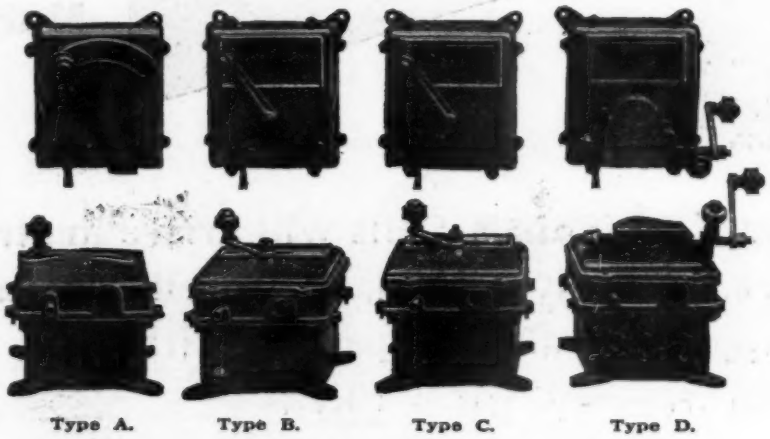

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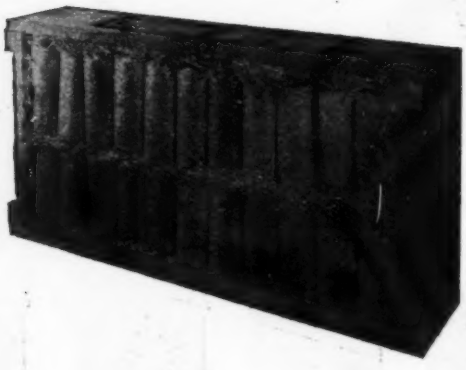

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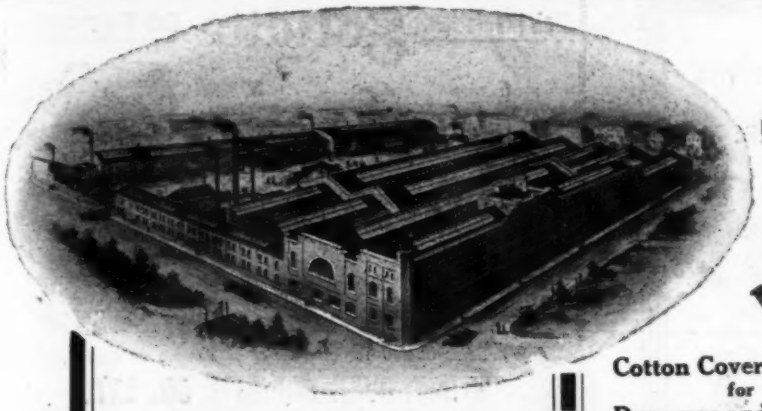

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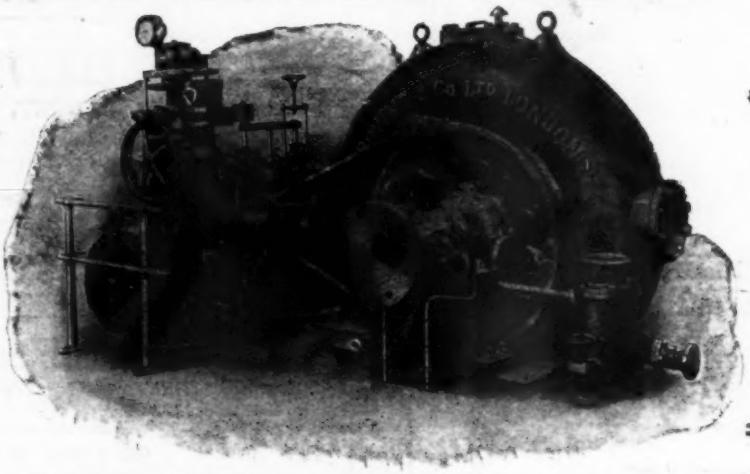

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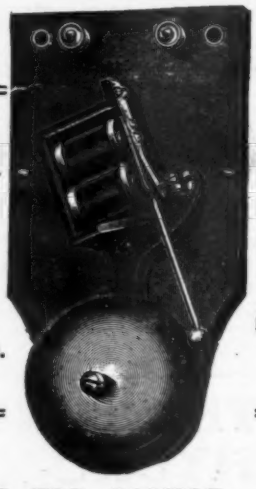

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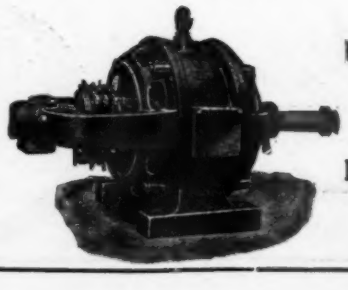

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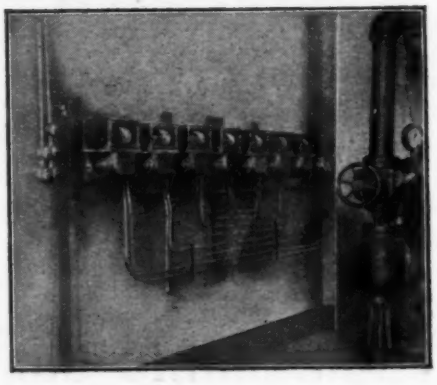

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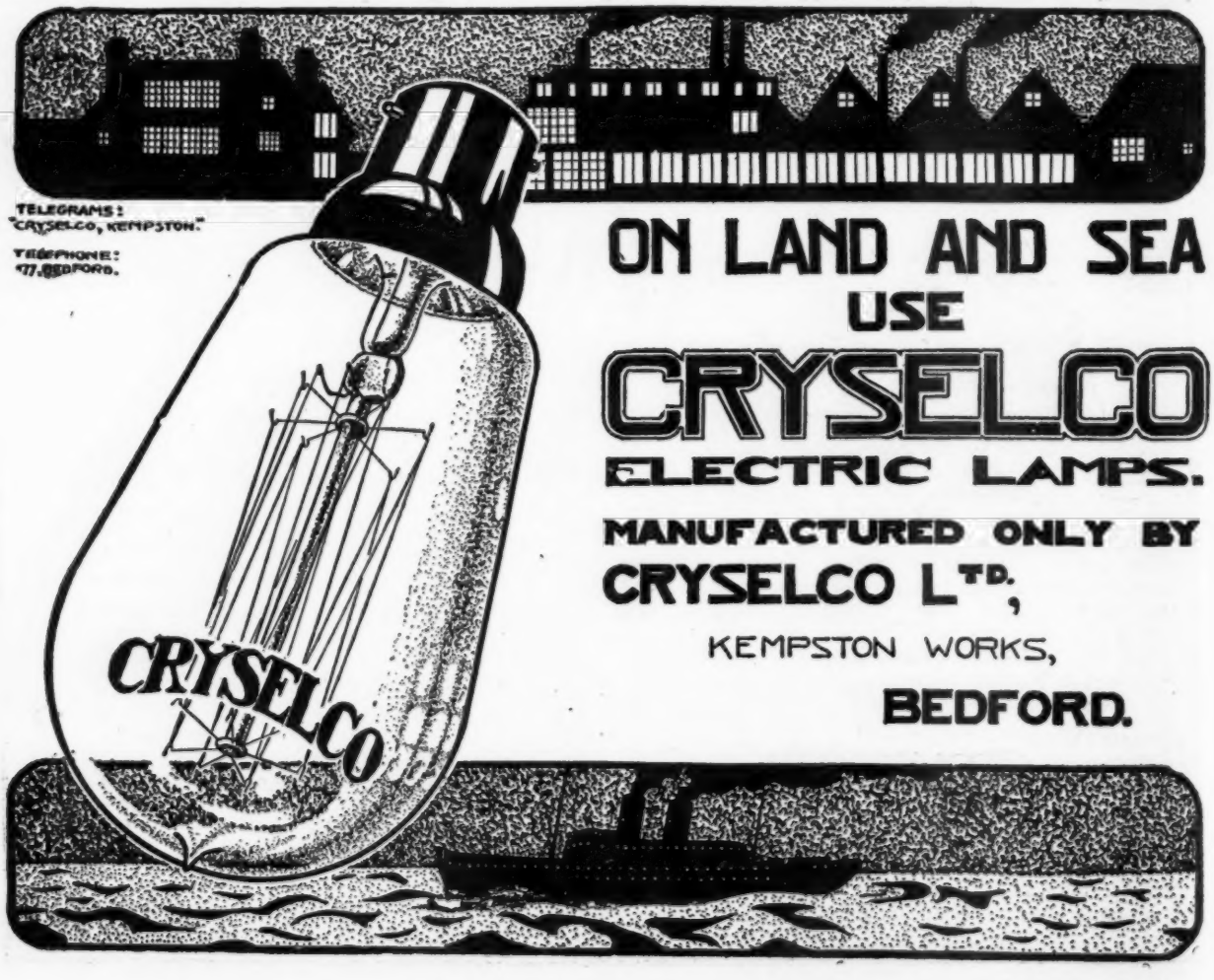

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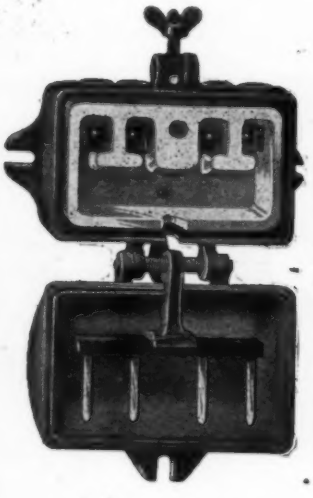

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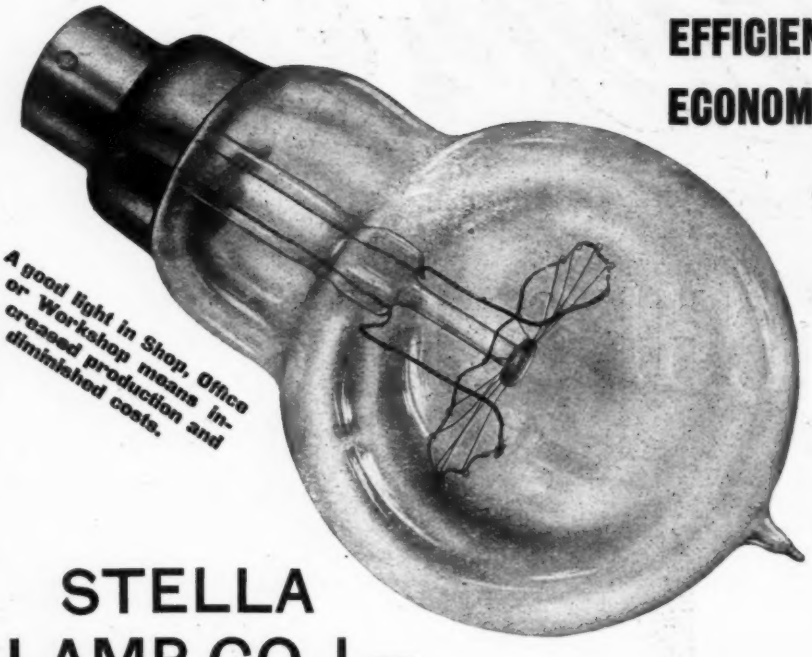

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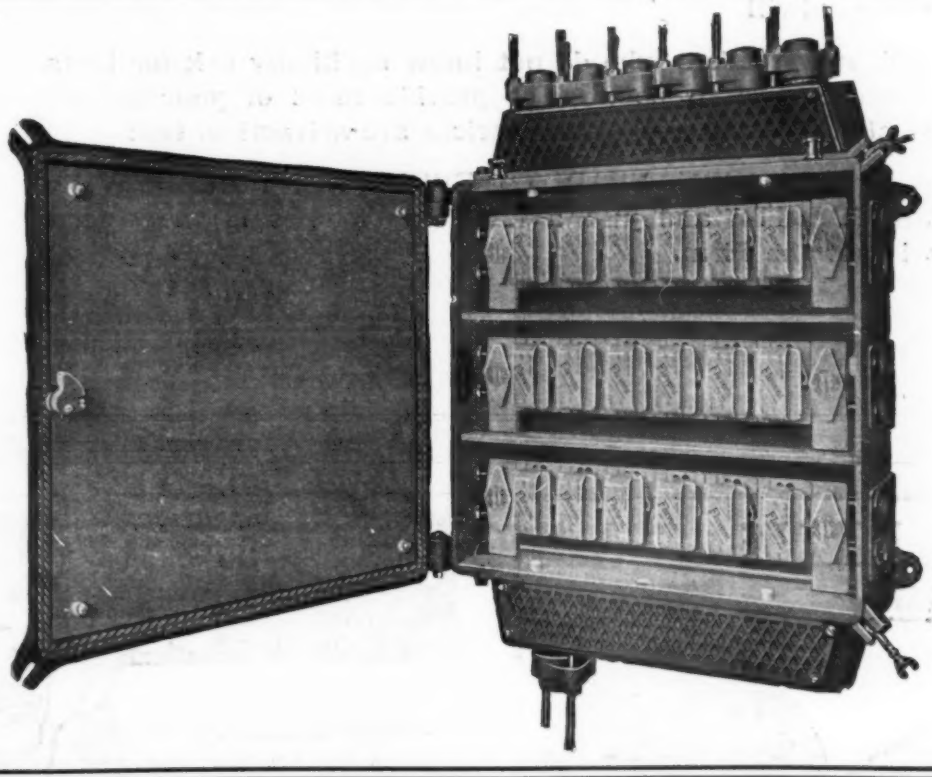

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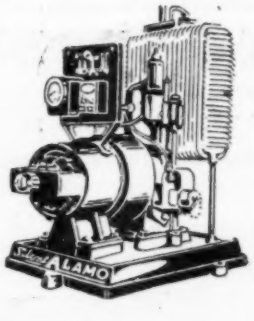

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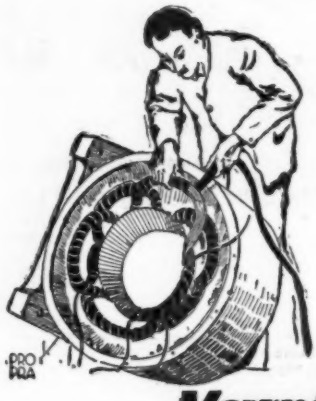

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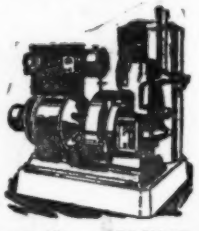

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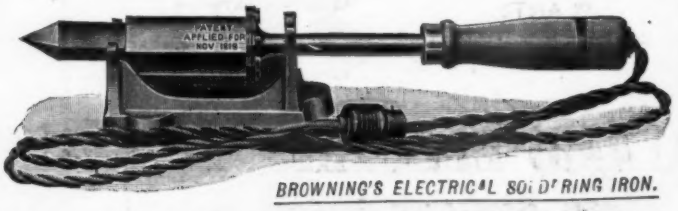

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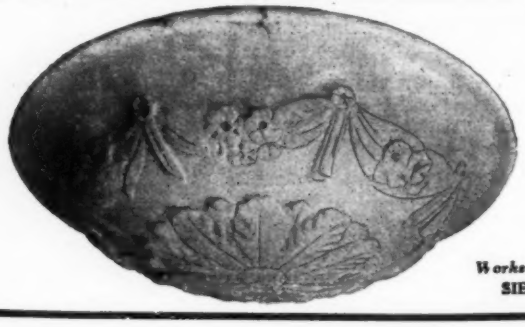

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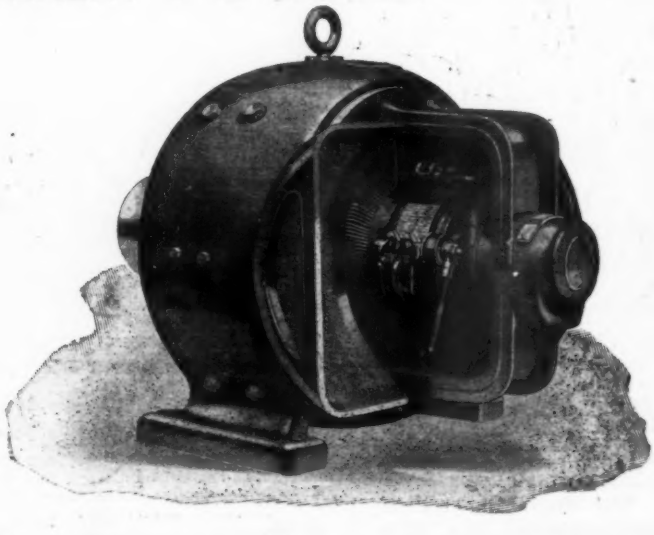

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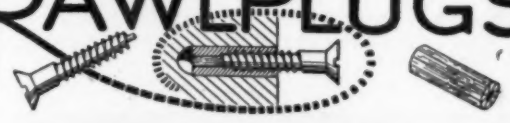

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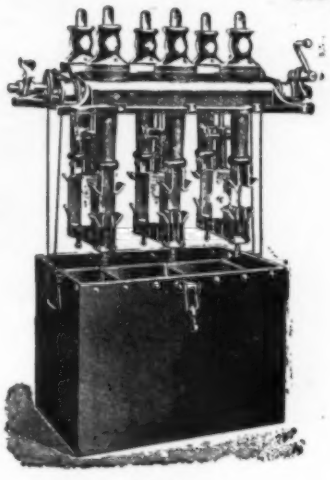

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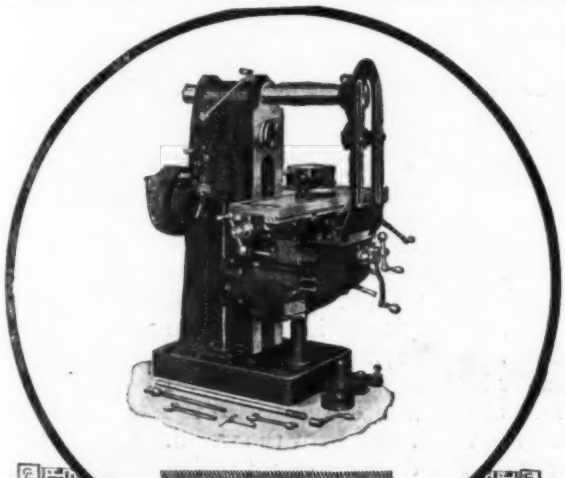

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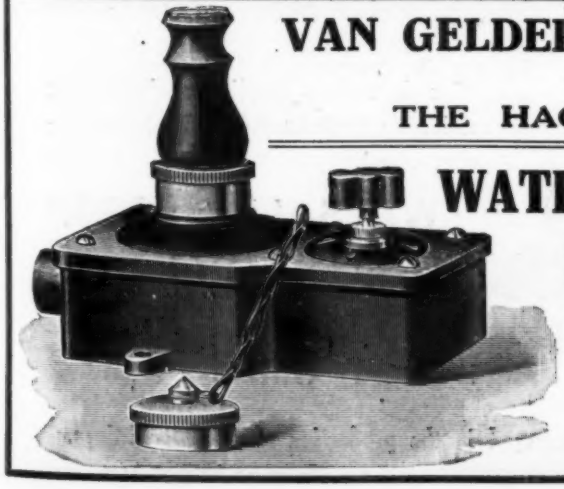

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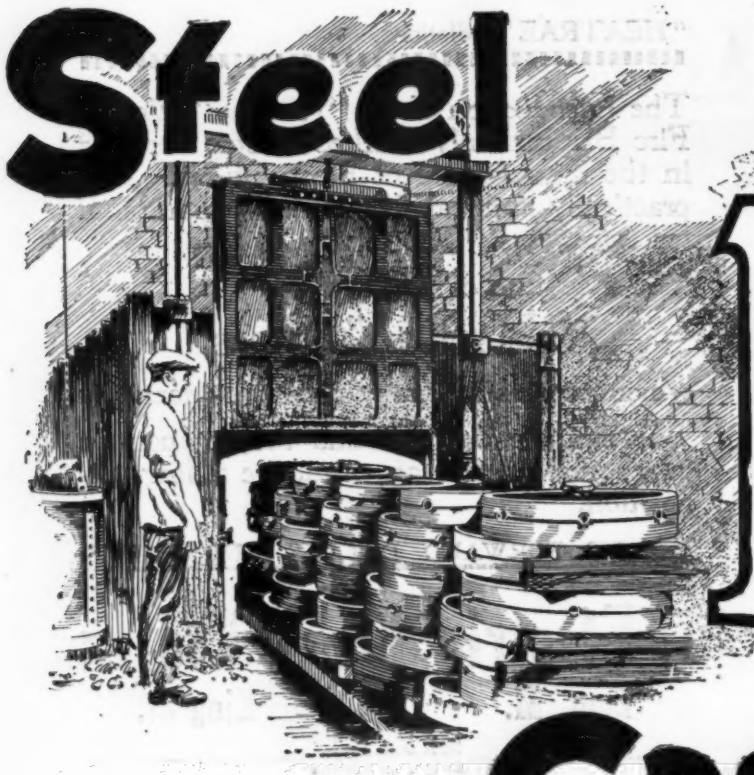

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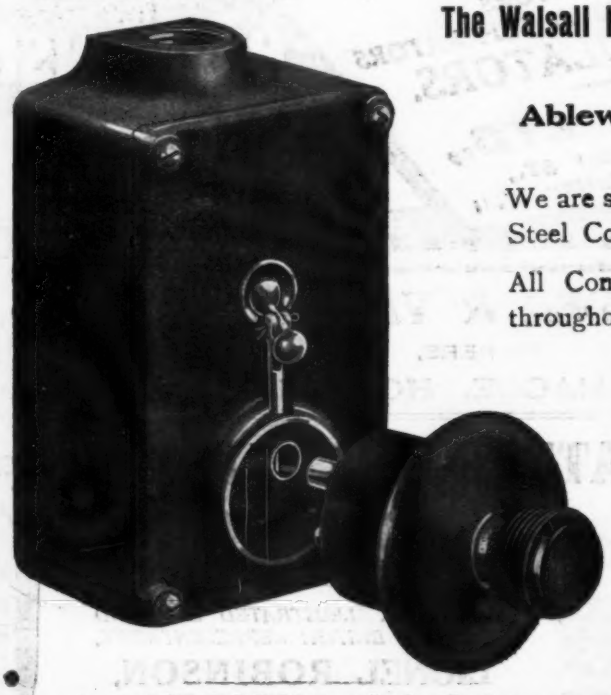

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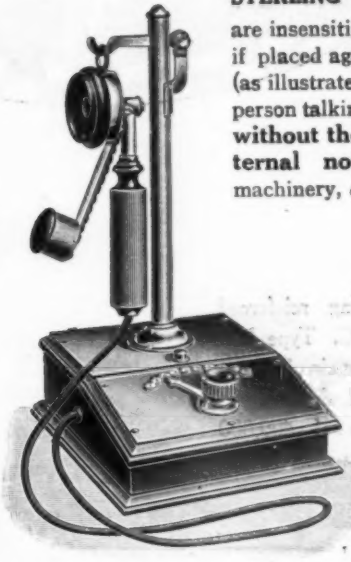

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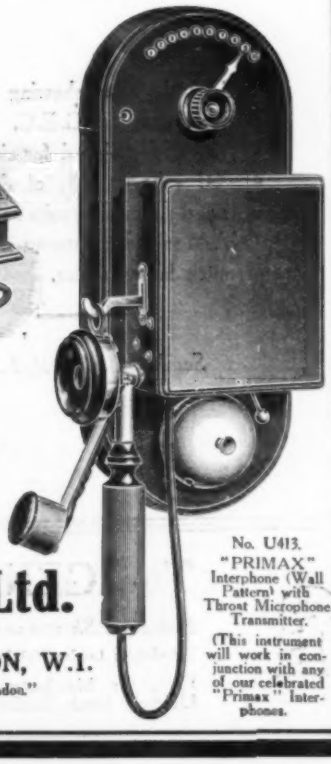

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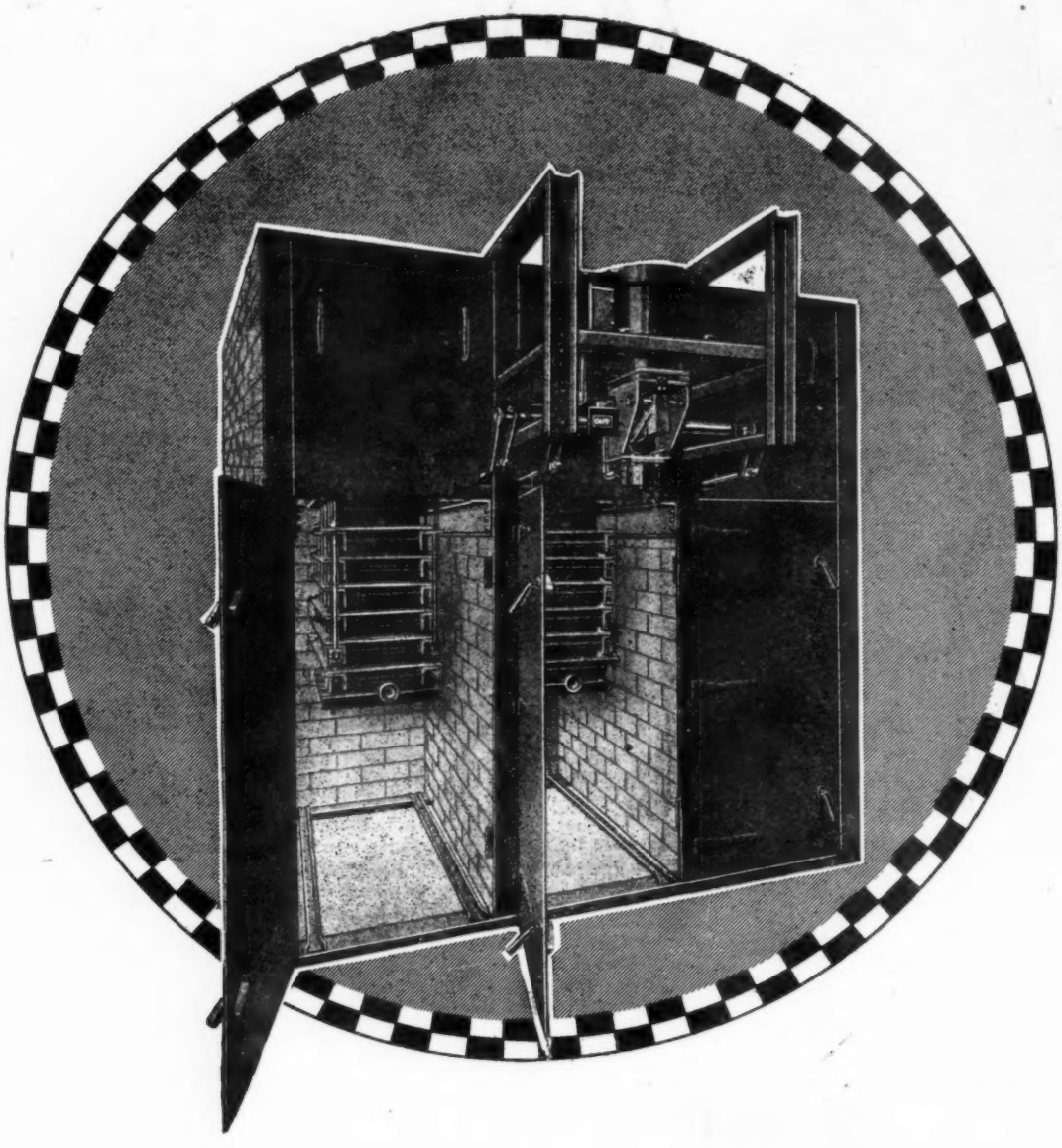

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(A 1044)

SPECIAL NOTICE.

OFFICIAL NOTICES, PATENT NOTICES, SITUATIONS VACANT, SITUATIONS WANTED, PARTNERSHIPS, AGENCIES, ARTICLES FOR SALE, ARTICLES WANTED, ETC.

Latest Time 5 p.m. WEDNESDAY.

¶. *New Copy and Alterations to Existing Trade Advertisements (with Blocks) should reach here*

Not later than FRIDAY.

FOR SALE.

Advertisements are inserted under this heading at 1s. 9d. per line.]

FOR SALE.

NEW D.C. MOTORS IN STOCK.

SEVERAL SIZES of EACH SIZE READY for IMMEDIATE DELIVERY.

Type.	Power.	Volts.	Speed.	Type.	
R1	½	250	1600	Open protected	Prices on Application.
R2	1	250	1600	"	
R3	2	250	1600	"	
R3	1	250	1300	"	
R4	2½	250	1550	"	
R4	2	250	1200	"	
R5	3	250	1050	"	
R5	3	480	1050	Enc. ventilated	
R5	4	480	1400	"	
R6	5	480	1250	"	
R7	5	480	900	"	
R7	8	480	1200	"	
R8	10	220	1000	Open protected	
R9	15	480	1200	Enc. ventilated	
R10	20	480	1000	"	

PLATING DYNAMOS.

P1	50 amps. 6	1600	Open protected	Prices on Application.

CUTTING BROS., LTD., Park Works, Stamford.

Telegrams: "Cutting, Stamford." Telephone No.: 12 Stamford. 1404

MOTORS, &c., FOR SALE.

ONE Mather & Platt. 80-KW., open type, compound wound interpole Dynamo, 230 volt, 600 R.P.M., complete with two pedestal bearings and belt pulley 21½ by 12. Quite new. Delivery expected any time now.

One 25-KW. Robey-Hawkins Steam Generating Set, 115 volts, steam pressure 100 lb. per square inch.

One 1½-H.P., 110 volt, 1,700 R.P.M., G.E.C. Shunt Motor.

One 1-H.P., 220 volt, 1,600 R.P.M., Johnson & Phillips shunt wound Motor.

One ½-H.P., 210 volt, 1,345 R.P.M., Siemens Bros. shunt wound Motor.

One 4½-H.P., 440 volt, 750 R.P.M., series wound Motor, by Westinghouse.

One 5-H.P., 1,000 R.P.M., 230 volt, Siemens Bros., shunt wound Motor.

Five 12-H.P., 440 volt, 500 to 900 R.P.M., variable speed Motors, Phœnix make, with Brookhirst starters.

One 38-H.P., 400 volt, Motor, by Electromotors.

One 165-KW., 440 volt, 375 R.P.M., Mather & Platt Generator.

One 20-KW., 210 volt, 825 R.P.M. Molmes Generator.

Two ¾ Exhaust Fans, 230 volts, 30 in. blades.

One 4½-KW. Portable Petrol Engine, by B.T.H. Co.

One 60 amp., 110 volt, 3-bearing spare Armature.

THE PREMIER ELECTRICAL ENGINEERING CO., LTD., 33, Market Street, Stalybridge. 4016

FOR SALE.

PETROL-PARAFFIN LIGHTING SETS.

FIVE 3½-KW., 110 volt, Austin Sets.

Two 4½-KW., 110 volt, Austin Sets.

Two 8-KW., 80 volts, Austin Sets.

One 8-KW., 80 volts, Barlaw Sets.

One 10-KW., 120 volts, Belliss Set.

Government surplus, guaranteed sound. Further particulars from—

FYFE, WILSON & Co., 31, Budge Row, E.C. 4. 3565

FOR SALE.—*Continued.*

R. O'BRIEN & CO.,

Wholesale Electrical Suppliers,

December 6th, 1920. 66, Mosley Street, Manchester.

Telephone Nos.:— Central 2273 & 7500.

Telegrams:— "Robaneo, Manchester."

STOCK OF NEW D.C. MOTORS.

Compare our Prices.

No. in Stock.	Type.	Maker.	B.H.P.	Volts.	R.P.M.	Pulley.	Rails.
2	Encl. vent.	E.C.C.	50	400/480	600	16 × 10	Yes
2	Protected.	Siemens.	30	400/480	750	14 × 8	Yes
5	Encl. vent.	E.C.C.	30	400/480	750	14 × 7	Yes
1	Protected.	Siemens.	25	400/480	810	12 × 7	Yes
1	Protected.	Siemens.	25	500/550	810	12 × 7	Yes
3	Encl. vent.	E.C.C.	20	400/480	850	8 × 6	Yes
8	Encl. vent.	E.C.C.	15	400/480	1000	8 × 6	Yes
7	Encl. vent.	E.C.C.	10	400/480	900	8 × 6	Yes
2	Encl. vent.	E.C.C.	8	400/480	1000	6 × 4	Yes
13	Encl. vent.	E.C.C.	5	400/480	1000	6 × 4	Yes
1	Protected.	Siemens.	5	400/480	1000	6 × 4	Yes
1	Protected.	Siemens.	3	200/240	1450	5 × 4	Yes
7	Encl. vent.	E.C.C.	3	200/240	900	5 × 4	Yes
25	Encl. vent.	G.E.C.	2	200/240	1050	5 × 4	Yes
49	Encl. vent.	E.C.C.	2	200/240	1250	5 × 4	Yes
1	Encl. vent.	E.C.C.	1½	200/240	1000	5 × 4	Yes
19	Protected.	B.K.B.	1½	200/240	1500	4 × 3	No
19	Tot. encl.	Verity	1	200/240	1600	Yes	Yes
14	Protected.	Crompton.	1	200/240	1600	3 × 3	Yes
74	Protected.	B.K.B.	¼	200/240	1350	4 × 3	No
1	Protected.	L.	¼	200/240	1500	Yes	No
83	Protected.	B.K.B.	¼	200/240	1500	Yes	No
4	Protected.	U.	¼	200/240	2000	Yes	No

1, new, E.C.C., compound-wound, open protected type, interpole Generator, 80 KW., 220 volts, 950 R.P.M., with regulator, pulley and rails.

STOCK OF SECOND-HAND D.C. MOTORS.

1	Tot. encl.	Verity.	3	200/240	1200	6 × 3½	Yes

STOCK OF NEW A.C. MOTORS.

Verity, open-protected type, squirrel-cage, Star Delta wound motors, 440 volts, 50 cycles, 3-phase with pulley (11 × 6) and rails.

Two 20-H.P., at 950 R.P.M.
Two 13½-H.P. „ 710 „
One 16-H.P. „ 950 „ . 777

ELECTRICAL PLANT FOR SALE.

Government Surplus.

ROTARY CONVERTERS.

ONE 660-KW., 5,000 volts, 50 cycles, 6-phase to 230 volts, D.C.

Two 375-KW., 10,000 volts, 50 cycles, 6-phase to 230 volts, D.C.

Two 1,000-KW., 6,600 volts, 50 cycles, 6-phase to 250 volts, D.C.

All above Westinghouse, complete with transformers and switchgear.

TRANSFORMERS, 3-PHASE, 50 CYCLES.

Three 500-KW., 11,000/440 volts.

One 1,200-K.V.A., 20,000/230 volts.

Two 1,875-K.V.A., 6,600/440 volts.

TURBO ALTERNATOR.

One B.T.H. Turbo Alternator with Condensing Plant, 940 K.V.A., 500 volts, 3-phase, 50 cycles.

A.C. MOTORS.

Two 250-H.P., 500 volts, 50 cycles, 3-phase.

Two 250-H.P., 3,000 volts, 50 cycles, 3-phase.

One 400-H.P., 550 volts, 50 cycles, 3-phase.

One 400-H.P., 420 volts, 50 cycles, 3-phase.

THE PHŒNIX ELECTRICAL CO., LTD., 82-86, Broomielaw, Glasgow. 3994

FOR SALE.—*Continued.*

W. H. PEASE & COMPANY,

8, Southampton Row, London, W.C. 1.

Telegrams: "Engipease, Westcent, London."

PLANT FOR SALE.

FOR IMMEDIATE DELIVERY.

ELECTRICAL PLANT.

Ref. No. Description.

1001.—600-KW. Vickers Back Pressure Turbine Set, complete with switchboard and condensing plant, 500 volts, 50 periods, 3-phase, with star connections.

1002.—250-KW. Westinghouse Rateau Impulse High Pressure Geared Double Helical Turbine Sets. Steam Turbine 4,000 R.P.M., direct coupled through gear to a 250-KW. Westinghouse Generator, shunt and compound wound, 440/575 volts on power circuit, 220/240 volts for lighting. Complete with switchboard. Slip rings are provided at the end of commutator for static balancing, also booster coupled direct to Generator through flanged coupling, 4 pole, 3.5 KW., 140 amps., 25 volts. The whole of the above plant is in all respects equal to new, and has only been run a few times.

1125.—400-KW. Westinghouse Impulse High Pressure Turbine Sets. Complete with Condenser and switchboard. New in 1911, and has been recently overhauled, and is in excellent condition. 440 volts, 2-phase, 60 periods at 3,600 R.P.M. Steam pressure 160 lb.

1127.—Willans Diesel Oil Engine, by Willans & Robinson, with compressor and dynamo direct coupled. Space occupied 28 ft. by 10 ft., height from floor level 14 ft. Engine 4 cyl., 320 B.H.P., 9 ft. flywheel, 250 R.P.M., 225 KW.

1143.—Willans-E.C.C.'s Direct Coupled Steam, D.C., Generating Sets, in first-class condition, 3 cyl. engine, 360 I.H.P., steam pressure 130 to 150 lb., speed 350 R.P.M. Generators compound wound with substantial shaft and bearings with ring lubrication, 220 KW.

1151.—Motor, 2.5 H.P., by Ingleby & Co., 400 volts, 3-phase, 50 periods. Complete with slide rails, pulley, and switch. Only been run about one month.

1152.—Centrifugal Pump, 2,000 galls. per hour, 25 ft. head, 1,450 R.P.M., belt driven, made by Holden & Brooke, Ltd., Manchester. No. 1,442. Only done one month's work.

1153.—One 568-KW. Parsons Turbo Set, 120 lb. steam pressure, 250/330 volts, D.C. Complete with surface condenser and circulating pumps. Driven by vertical compound steam engine.

1154.—850-KW. Fraser & Chalmers Turbo Generating Set, 3,000 R.P.M., 150 lb. steam pressure, direct coupled to 320/340 volt, 50 periods Alternator. Exciter 65 volts, 80 amps., by Siemens Bros. Complete with condenser plant, air filter, &c.

1155.—Two 1,000-KW. Parsons Reaction Turbine Sets, 6,600 volts, 1,500 R.P.M., 50 periods, 3-phase, with steam at 150 lb. pressure at stop valve. Complete with surface condenser, air pump, circulating pump, &c.

1156.—Two 500-KW. Parsons Turbine Sets for working on 150 lb. steam, 1,800 R.P.M., 500 volts, D.C., or 3-wire, 250 volts. Complete with condenser and fittings.

1157.—200-KW. Willans Exhaust Turbine Set, 160 lb. steam, 460 volts, 3,000 R.P.M. Complete with low level jet condenser, pump, &c.

1147.—One 1,050-KW. Turbine Generating Set, by Oerlikon and Co., Zurich, 6,000 volts, 3-phase, 50 periods. Complete with surface condenser, air pump, and circulating pump, and switchgear.

1146.—750-KW. Steam Generating Set, by Belliss Morcom, direct coupled to 2,200 volt, 60 periods, single-phase alternator. Complete with exciter. In first-class condition.

1170.—10-KW. Thorneycroft Lighting Set, 220 volt, compound, petrol paraffin, 4 cycle Engine. Complete with dynamo, bedplate, 2 fuel and 2 water tanks, and silencer.

1171.—Crompton Alternator, open type, 3-phase revolving field type, output 200 KW. at .8 power factor, 440 volts, 50 cycles, 168 R.P.M., running in self-oiling pedestal bearings. Bedplate, direct coupled exciter of the one-bearing type, and free shaft end to receive half coupling. The exciter shunt regulator is suitable for mounting on a panel of switchboard.

1176.—Three Electric Generating Sets, each consisting of one 250-H.P. horizontal cross compound steam engine, with Corliss type of valve gear, jet condenser, and air pump, made by H. Bollinckx, Brussels. Driving belt by one 8-pole, shunt wound, continuous current dynamo, 140 volts, 1,700 amps., 320 R.P.M., on cast-iron bedplate mounted on slide rails, and made by Messrs. Brown, Boverie & Co.

(Continued at top of next Column.)

(Continued from previous Column.)

Ref. No. Description.

1174.—One Electric Generating Set, consisting of one 400-H.P. horizontal cross compound steam engine, with Corliss type of valve gear, jet condenser, and diaphragm, made by H. Bollinckx, Brussels, driving by belt, one 6-pole, compound wound, continuous current dynamo, 350 volts, 550 amps., 325 R.P.M., mounted on cast-iron bedplate, mounted on slide rails, made by Messrs. Brown, Boverie & Co., of Baden, Schweiz.

1175.—Two 2,000-KW. Willans & Robinson Steam Turbine Sets, direct coupled to Siemens Bros. Alternators, 2,200 volts, 3-phase, 50 periods at 3,000 R.P.M., designed for steam pressure of 100 lb. per sq. in. and fitted with integral exciter at 100 volts, and ventilating fan self-contained with rotor.

1176.—50-KW. Willans & Robinson 2-crank, high speed engines for steam at 175 lb. per sq. in., with tachometer, steam separator, steam gauge, and sight feed lubricator, coupled to a shunt wound dynamo, by Mather and Platt, 220 amps., 250 volts, 450 R.P.M. Complete with spare armature.

1177.—50-KW. Willans & Robinson, 100 amps., 460/500 volts, 450 R.P.M. Generator by Mather & Platt, Manchester. Engine, two crank, high speed, for steam at 175 lb. per sq. in., with tachometer, steam gauge, and sight feed lubrication. Direct coupled to a continuous current dynamo.

1178.—Willans & Robinson 150-KW., 300 amps., 460/500 volts, 450 R.P.M., Generator, compound wound, by Mather and Platt, two crank, high speed, steam engine for steam at 175 lb. per sq. in. Complete with tachometer, steam separator, steam and vacuum gauges, sight feed lubricator, also jet condenser.

1179.—One new Steam Turbine, 900 H.P., 3,000 R.P.M., 234 lb. steam pressure, extraction pressure 70 lb. about. Complete with condenser and auxiliaries. For immediate delivery.

1180.—One new Steam Turbine, 450 H.P., 3,000 R.P.M., 234 lb. steam pressure, extraction 70 lb. about. Complete with condenser and auxiliaries. For immediate delivery.

1181.—One new Steam Turbine, 750 H.P., with reduction gear, 3,600/900 R.P.M., steam pressure 213 lb. Complete with condenser and auxiliaries. For immediate delivery.

1182.—Two new Steam Turbines, 1,500 H.P., with reduction gear, 300/750 R.P.M., steam pressure at 213 lb. Complete with condenser and auxiliaries. For immediate delivery.

1183.—One new Steam Turbine, 2,250 H.P., 3,000 R.P.M., steam pressure 185 lb. Complete with condenser and auxiliaries. For immediate delivery.

1184.—Three new Steam Turbines, 2,250 H.P., 3,000 R.P.M., steam pressure 213 lb. Complete with condenser and auxiliaries. For immediate delivery.

1185.—Two new Steam Turbines, 3,600 H.P., 3,000 R.P.M., steam pressure 185 lb. Complete with condenser and auxiliaries. For immediate delivery.

1186.—Two new Steam Turbines, 4,500 H.P., 3,000 R.P.M., steam pressure 213 lb. Complete with condenser and auxiliaries. For immediate delivery.

1187.—One new Steam Turbine, 750 H.P., 3,000 R.P.M., steam pressure 213 lb. Complete with condenser and auxiliaries. For immediate delivery.

1188.—One new Steam Turbine, 2,000 H.P., 3,000 R.P.M., steam pressure 213 lb. Complete with condenser and auxiliaries. For immediate delivery.

1189.—6 cyl. Diesel Generating Set, 420 H.P., 375 R.P.M., direct coupled to Generator, 220/440 volts. Brand new, and ready for immediate delivery.

1190.—6 cyl. Diesel Generating Set, 250 H.P., 375 R.P.M., direct coupled to Generator, 220/440 volts. Brand new, and ready for immediate delivery.

1191.—6 cyl. Benz. Oil Driven Generating Set, 300 H.P. at 340 R.P.M., 250/300 volts, direct coupled. Brand new, and ready for immediate delivery.

1192.—Two 180-KW. Combined Sets, engines by Belliss & Morcom, three crank, compound, direct coupled to Holmes D.C. Generators, which can be used as either shunt or compound machines according to the position of the change-over switch. As shunt machines the voltage can be varied between 445 and 500 volts, with an output of approximately 360 amps, and as a compound machine the potential is constant at 550 volts between 30 and 300 amps. The three high pressure cylinders of each machine are 7½ in. dia., and the three low pressures 13 in. by 8 in. stroke, the speed being 400 to 420 R.P.M. Built in 1902. Both sets are in first-class condition, and have been very little used.

1193.—48-KW., 220 volt, 220 amp., 4 pole, compound wound Generator, by Maver & Coulson, three bearing type with combined pulley, flywheel, speed 650 R.P.M., with two slide rails.

1194.—Two 260 B.H.P., at 450 R.P.M. Diesel Engines, 6 cyl., 4 stroke, cyls. 9.85 in. dia. by 14.16 in. stroke. Weight of engine 7 tons, with spare parts, compressor, oil and water pumps, centrifugal governor, and all fittings.

(Continued on next page.)

FOR SALE.—*Continued.*

(Continued from previous page.)

1195.—16 Sets of 250 B.H.P. at 500 R.P.M. Benz. Benzol or Paraffin Engines, 6 cyl., 4 stroke, fitted with H.T. magneto, twin carburetters, 2 stage air pump, &c.

1196.—Two new Diesel Generating Sets, 1,500 B.H.P., 700 KW., direct coupled to Tandem Generator, 220/440 volts. For immediate delivery.

1197.—Five new Diesel Generating Sets, 1,200 B.H.P., 560 KW., direct coupled to Tandem Generator, 220/440 volts. For immediate delivery.

1198.—Two new Diesel Generating Sets, 1,000 B.H.P., 460 KW., direct coupled to Tandem Generator, 220/440 volts. For immediate delivery.

1199.—Four new Diesel Generating Sets, 550 B.H.P., 255 KW., direct coupled to Tandem Generator, 220/440 volts. For immediate delivery.

1200.—Two new Diesel Generating Sets, 300 B.H.P., 140 KW., direct coupled to Tandem Generator, 220/440 volts. For immediate delivery.

1201.—Two new Diesel Generating Sets, 250 B.H.P., 120 KW., direct coupled to Tandem Generator, 220/440 volts. For immediate delivery.

1202.—Two new Diesel Generating Sets, 145 B.H.P., 70 KW., direct coupled to generator, 220/440 volts. For immediate delivery.

1229.—400-KW. Willans, Disk and Drum Turbine, coupled through David Brown & Co.'s gear to G.E.C. shunt wound Generator, 440 volts. Complete with condenser and all switchgear. 3745

D.C. MOTORS AND DYNAMOS IN STOCK.

NEW AND SECOND-HAND.

No. in Stock	H.P.	Volts	Speed	Make
1	2½	100	1000	Lahmeyer.
2	4	110	1400	McLure & Whitfield.
1	7½	110	1050	Blackburn & Starling.
1	.25	200	1100	Crompton.
2	1	220	1700	Siemens.
2	1	220	1550	Newton.
5	2	220	1400	Mawdsley.
1	3	230	1450	Simoon.
1	4	220	950	B.T.H.
1	5	200	2000	Lahmeyer.
2	7½	220	1320	Siemens
1	10	220	870	Siemens
3	2	500	1400	Mawdsley.
1	2½	400	1200	B.T.H.
1	2½	480/530	1300	B.T.H.
5	5	440	1300	Siemens.
1	6	530	1100	Cutting.
1	7½	400	1800	B.T.H.
2	8	500	1500	Simoon.
1	8	500	1550	Simoon.
1	9	440	1250	Victoria Dynamo.
2	10	460	1000	Flather.
2	11	440	920	Phœnix.
1	12	500	1400	Simoon.
1	15	440	1150	Victoria Dynamo.
1	15	440	900	Siemens.
1	20	440	820	Siemens.
1	50	460	600	Parker.

Also number of A.C. Motors, single and three-phase, and D.C. Dynamos, 100 volts, 30 and 40 ampere. All prices reduced to clear stocks.

THE VICTORIA ELECTRIC PLANT CO., Spenser Street, Westminster, S.W. 1.

'Phone: Victoria 4122-4123. 'Grams: Vicminster, Sowest, London. 1080

R. H. LONGBOTHAM & CO., LTD.,

41, Station Road, Doncaster;
and at Milburn House, Newcastle-on-Tyne.

Tel.: 576 Doncaster.
867 Newcastle.

Telegrams:
"Machinery, Doncaster."

FOR SALE.

TWO Lighting Sets, 30-KW. bipolar Dynamos, by E.C. Co., 250 volts, 120 amps.

One 40-B.H.P., 220 volts, 400 R.P.M., Belliss-Peebles, Vertical Set.

One Babcock & Wilcox Water Tube Boiler, capacity 3,454 sq. ft., without superheater, but with chain grate stokers.

One Surface Condenser, capacity 420 sq. ft. cooling surface, having solid drawn brass tubes, complete with Air and Circulating Pumps.

Four Rotary Mining Drills, 4 H.P., 440 volts, D.C.

One Hopkinson Coal Cutter, with 25-H.P. Motor, 450 volts, D.C., complete with Jib and Chain.

One 29½-H.P., 110 volts, series wound Motor. 5277

FOR SALE.—*Continued.*

TRANSFORMER MOTORS AND GENERATORS FOR SALE.

ONE 75-K.V.A. oil cooled Transformers, 3-phase, 50 cycles, 3,000/418 volts, by Westinghouse Co.

One 50-K.V.A. oil cooled Transformer, 3-phase, 25 cycles, 400/110 volts, by Johnson & Phillips.

One 80-H.P. slip ring Motor, 3-phase, 25 cycle, 400/440 volts, 480 R.P.M., by Westinghouse Co.

One Motor Converter, single-phase, 25 cycle, 110 volts to 12 volts, 20 amps., by Crypto Co.

One 50-H.P. slip ring Motor, 3-phase, 50 cycle, 440 volts, 950 R.P.M., by G.E.C.

Four 1-H.P. squirrel cage Motors, 2-phase, 50 cycle, 200 volts, 1,400 R.P.M., by B.T.H.

One 18-H.P. shunt interpole Motor, 440 volts, 210/630 R.P.M., by Westinghouse Co.

One 15-H.P. shunt interpole Motor, 460 volts, 840 R.P.M., by Newton.

Two 12-H.P. shunt interpole Motors, 440 volts, 300/900 R.P.M., by Phœnix.

One 3½-H.P. shunt interpole Motor, 440 volts, 950 R.P.M., by Newton.

One 5-H.P. shunt Motor, 440 volts, 1,050 R.P.M., by Newton.

One 25-H.P. shunt Motor, 220 volts, 950 R.P.M., by Siemens.

Two 20-H.P. shunt Motors, 220 volts, 750 R.P.M., by Morris Hawkins.

One 35-KW. shunt interpole Dynamo, 230 volts, 1,100 R.P.M., by the Brush Engineering Co.

One ½-H.P. shunt Motor, 110 volts, 1,000 R.P.M., by Verity.

One 3½-H.P. shunt Motor, 110 volts, 825 R.P.M., by Siemens.

One 3-H.P. shunt Motor, 110 volts, 1,200 R.P.M.

One 12-H.P. series wound Motor, 110 volts, 850 R.P.M., by Watson Laidlaw.

One 500 amp., 6 volt, Plating Dynamo, by Canning.

One 12-H.P. pillar type Starter, 110 volts, by Westinghouse, brand new.

One 45-H.P. pillar type Starter, 110 volts, by Westinghouse, brand new.

All the above Machines are modern, equal to new, and complete with switch gear in most cases.

THE MIDLAND COUNTIES ELECTRICAL ENGINEERING CO., LTD., 136, Sandon Road, Birmingham. 3652

ELECTRICAL PLANT FOR SALE.

Government Supplies.

ONE 850-KW., 500 volts, 50 cycle, 3-phase, Turbo Set, with condensing plant. New 1916.

One 350-KW., 500 volt, D.C. Belliss-Lancashire Triple Expansion Set, with ejector condenser. New 1913.

One 140-KW., 500 volt, D.C. Howden-Siemens Triple Expansion Set. New 1911.

One 850-KW., 341 volt, 50 cycle, 6-phase, to 440 volts D.C., 750 R.P.M. Rotary Converter, by Siemens. 1916.

Two 1,875-K.V.A., 6,600/440 volt, 3-phase, 50 cycle Berry oil-cooled transformers. New.

Motor Generator, 415 volts, 3-phase, 50 cycles, to 110 volts D.C., 33-KW. New. With Switchboard.

One new 25-KW. Balancer, by Lancashire Dynamo Co., for 460 volts, with complete set of spares.

One 320-KW., 460 volt Balancer, by Vickers, consisting of two 160-KW. compound, interpole, 2-bearing machines coupled together.

One 175-K.V.A., 500 volt, 50 cycle, 425 R.P.M., 3-phase Alternator, with direct coupled exciter.

One 700-KW., 3,000 volt, 50 cycle, 3-phase Steam Set, with exciter.

Two 3-throw Hydraulic Pumps, for 2,240 lb. pressure, with 150-H.P., 415 volt, 50-cycle, 3-phase Motors and control panels.

One Vertical, 2-stage Air Compressor, by Tilghmans, with 145-H.P., 440 volt, 3-phase, 50 cycle Motor and control gear.

Two 3-throw Hydraulic Pumps, with 200-H.P., 440 volt, 25 cycle, 3-phase Motors and control panels.

One 200-KW., 230 volt Vertical H.S. Steam Set.

One 250-KW., ditto.

One 360-KW., ditto.

Also many other items.

THE PHŒNIX ELECTRICAL CO., LTD., 32-36, Broomielaw, Glasgow. 3975

ELECTRIC MOTORS.

A.C., 1, 2 and 3-phase, 200 v. and 415 v., ¼-H.P. to 45-H.P.

D.C., 110 v., 220 v., and 480 v., ¼-H.P. to 50-H.P.

Dynamos, 50/70 v., 110/140 v., 8 amps. to 60 amps.

Motor Generator Sets, by Dick, Kerr, 75-H.P. Motors one 200 v. one 400 v., direct coupled to 1,700 amps., 31 v., 700 R.P.M. Dynamos.

Motor Generator Set, by G.E.C., 50-H.P. Motor, 200 v., direct coupled to Dynamo, 1,110 amps., 27 v., 640 R.P.M.

Plating Dynamo, by Rees Roturbo, 8 v., 500 amps., 850 R.P.M.

Plating Dynamo, by Canning, 6 v., 750 amps., 850 R.P.M.

M. RYAN, 121, Middlesex Street, E. 1. Avenue: 7090. 3508

FOR SALE.—*Continued.*

ELECTRICAL PLANT FOR SALE.

New and Second-Hand, in Good Condition.

DYNAMOS.

Ref. No.	kw.	Volts.	Speed.	Type.	Make.
S 121	50	110	720	Shunt	E.C.C.
S 226	495	220	300	Shunt	Peebles.
S 429	3 (2 of)	230	600	Comp. intpl.	West'house.
S 208	235	240	300	Shunt	West'house.
S 441	200	480	350	Comp.	Electrical Co.
S 34	150	500	380	Shunt	J. & P.

ALTERNATORS.

Ref. No.	kw.	Phases.	Volts.	Speed.	Make.	Cycles.
S 115	750	1	2000	277	G.E.C.	60
S 423	200	3	2400	300	Westinghouse	50

D.C. STEAM SETS.

Ref. No.	kw.	Volts.	Make.
S 494	15	100	Browett-Jackson.
S 412	45	100/125	Belliss-B.T.H.
S 248	12	200/250	Sentinel-Verity.
S 301	250	220	Willans-Siemens.
S 628	250	220	Howden-Lancs. Dyn'o.
S 74	140	250	Belliss-W'house.
S 504	50 (2 of)	250	Willans-Mather & Platt.
S 501	150	440/525	Belliss-Parker.
S 463	500	445/480	Belliss-Siemens.
S 504	50	460/500	Willans-Mather & Platt.
S 504	150 (2 of)	460/500	Willans-Mather & Platt.
S 309	180	500	Belliss-Holmes.
S 236	375	500	Willans-E.C.C.
S 516	425	560	Willans-Dick Kerr.

D.C. STEAM TURBINES.

Ref. No.	kw.	Volts.	Type.	Make.
S 2	125	480	Shunt	Parsons
S 647	1000 (3 of)	440	,,	Vickers.

A.C. STEAM SETS.

Ref. No.	kw.	Phase.	Volts.	Cycles.	Make.
S 403	300	3	440	30	McLellan-Lancs. Dyn.
S 414	70	3	570	25	Sissons-G.E.C.
S 414	135	3	570	25	Sissons-G.E.C.
S 414	150	3	570	25	Sissons-G.E.C.

A.C. STEAM TURBINES.

Ref. No.	kw.	Phase.	Volts.	Cycles.	Make.
S 430	1500	3	230	23½	Parsons.
S 452	100 (2 of)	3	440	50	B.T.H.
S 80	300	2	2000	50	Parsons-E.C.C.
S 645	2000	3	6600	50	Willans-Dick, Kerr.
S 697	1500	3	3000	50	Brush-Parsons.

PLANT LIST (STEAM SETS, MOTORS, &c.) SENT UPON REQUEST.

BRITISH CENTRAL ELECTRICAL CO., LTD.,
6 and 8, Rosebery Avenue, London, E.C.1.

Telephone Numbers: Holborn 5848, 5849 and 5850. 4059

NEW MOTORS. DELIVERY FROM STOCK AT MAKERS' PRICES.

SINGLE-PHASE, 50 PERIODS, 100/200 VOLTS.

THREE ¼-H.P. Century, 1,460 R.P.M., two 1-H.P. Century, 1,460 R.P.M., seven 1-H.P. Brook, 1,440 R.P.M., two 1-H.P. Brook, 940 R.P.M., seven 1½-H.P. Brook, 1,440 R.P.M., two 1½-H.P. Brook, 940 R.P.M., one 2-H.P. Brook, 940 R.P.M., one 3-H.P. Brook, 1,440 R.P.M., one 3-H.P. Brook, 940 R.P.M., two 4-H.P. Brook, 1,440 R.P.M.

THREE-PHASE, 50 PERIODS, 400/440 VOLTS.

Two 1-H.P. Parkinson, 1,440 R.P.M., three 2-H.P. Parkinson, 1,440 R.P.M., two 3-H.P. Parkinson, 1,440 R.P.M., four 3½-H.P. Parkinson, 940 R.P.M., one 5-H.P. Parkinson, 1,440 R.P.M., one 5-H.P. Parkinson, 940 R.P.M., four 7½-H.P. Parkinson, 1,440 R.P.M., two 7½-H.P. Parkinson, 940 R.P.M., one 10-H.P. Parkinson, 1,500 R.P.M., two 10-H.P. Parkinson, 750 R.P.M., one 12-H.P. Parkinson, 1,440 R.P.M., four 12-H.P. Parkinson, 940 R.P.M., one 14-H.P. Parkinson, 720 R.P.M., one 14-H.P. Parkinson, S.R., 710 R.P.M., one 25-H.P. E.C.C., S.R., 950 R.P.M., one 6-H.P. Brook, 1,400 R.P.M.

DIRECT CURRENT, 500 VOLTS.

One 5-H.P. E.C.C., 1,000 R.P.M., three 7½ H.P., Siemens 1,320 R.P.M., one 8-H.P. Crompton, 870 R.P.M., one 15-H.P. E.C.C., 1,060 R.P.M.

SECOND-HAND MOTORS IN STOCK.

SINGLE-PHASE, 50 PERIODS, 100/200 VOLTS.

One ¼-H.P., 940 R.P.M., one 3-H.P., 1,420 R.P.M.

THREE-PHASE, 50 PERIODS, 440 VOLTS.

One 10-H.P., 1,440 R.P.M.

DIRECT CURRENT, 100/110 VOLTS.

One 2-H.P., 1,550 R.P.M., one 4-H.P., 550 R.P.M.

DIRECT CURRENT, 500 VOLTS.

One 9-H.P., 1,200 R.P.M.

MIDLAND DYNAMO CO., LTD., 64, Belgrave Gate, Leicester.

1194

FOR SALE.—*Continued.*

MYLAN & SMITH (Engineers), Ltd.
SHEFFIELD.

ELECTRIC MOTORS. Only best makes. Many new, all thoroughly overhauled and tested before despatch.

TWO-PHASE, 50 PERIODS, 200 VOLTS.

One 1-H.P., 1,400 R.P.M., squirrel cage.
One 2-H.P., 690 R.P.M., slip-ring, totally enclosed, crane rated.
One 5-H.P., 960 R.P.M., squirrel cage.
Two 10-H.P., 1,440 R.P.M., squirrel cage.
One 11-H.P., 960 R.P.M., slip-ring.
One 20-H.P., 960 R.P.M., slip-ring.
One 50-H.P., 960 R.P.M., slip-ring.
Two 50-H.P., 940 R.P.M., slip-ring.

THREE-PHASE, 25 PERIODS, 400/440 VOLTS.

Twelve 7½-H.P., 1,440 R.P.M., squirrel cage, each with pulley and auto release drum starter.

THREE-PHASE, 50 PERIODS, 400/440 VOLTS.

Four 5-H.P., 1,400 R.P.M., squirrel cage.
Sixteen 2½ to 60-H.P., 1,400, 960, or 720 R.P.M., squirrel cage Motors.
Twelve 5 to 50-H.P., 1,400, 960, 720, or 480 R.P.M., slip-ring Motors.

DIRECT CURRENT, 220/240 VOLTS.

One 3-H.P., 740 R.P.M., enclosed ventilated, compound with rails, pulley and control panel.
One 5-H.P., 500 R.P.M., enclosed ventilated, shunt, control panel, with contact or breaker.
One 5-H.P., 700 R.P.M., totally enclosed compound, with drum controller and main switch.
Also various protected and enclosed Motors from 4-H.P., to 30-H.P., all 220 volts, various speeds.

DIRECT CURRENT, 440 AND 500 VOLTS.

Twenty-six 2-H.P. to 35-H.P., protected and enclosed, shunt wound, various speeds.
One 200-H.P., 500 R.P.M., compound wound Motor, open protected type, with three bearings and slide rails.

CRANE RATED MOTORS, ALL SERIES WOUND INTERPOLE, TOTALLY ENCLOSED.

One 15-H.P., 540 R.P.M., 220 volts.
Six 30-H.P., 640 R.P.M., 220 volts.
Three 50-H.P., 630 R.P.M., 220 volts.
Four 23-H.P., 510 R.P.M., 440 volts.

DIRECT CURRENT GENERATORS OR MOTORS.

One 235-KW. (300-H.P.), 300 R.P.M., 230/240 volts, shunt wound, engine type Generator or Motor, with outboard bearing, shaft and half coupling.
One 300-KW. (450-H.P.), 300 R.P.M., 440 volt, compound wound, engine type Generator or Motor, with outboard bearing, shaft and half coupling.

MYLAN & SMITH (ENGINEERS), LTD., 10, East Parade, Sheffield. Also at 10, Park Row, Nottingham.

'Phone: 760 Central, Sheffield.
'Grams: "Topical," Sheffield. 3419

FOR SALE.

D.C. MOTORS. Equal to new. Just purchased while running. All bargains.

440 VOLTS. VARYING SPEEDS.

70-H.P. Aston.	Three 15-H.P. Phœnix.
40-H.P. Siemens.	13½-H.P. Siemens.
30-H.P. Crompton.	11-H.P. A.S.E.A.
30-H.P. Phœnix.	10-H.P. Siemens.
20-H.P. Crompton.	Three 5-H.P. Veritys.
20-H.P. Phœnix.	5-H.P. Vickers.
16½-H.P. Vickers.	5-H.P. B.T.H.

CHARLES PURDEN, LTD., Lancaster Street, Birmingham.

FOR SALE.

MOTOR GENERATOR, consisting of two 50-H.P. slip ring Motors, by A.E.G., 2,150 volts, 50 periods, 3-phase, 575 R.P.M., direct coupled to D.C., 6-pole Crompton Generator, 500/550 volts, 136 amps.

Motor Generator consisting of 100-H.P. Mor'-y, 3-phase, slip ring Motor, 2,000 volts, 50 periods, 975 R.P.M., direct coupled to D.C., 6-pole Morley Generator, 500/550 volts, 140 amps.

All machines are self contained, and will be sold as separate Motors and Generators if required.

WESTERN ENGINEERING CO., Swansea. 3449

FOR SALE.—*Continued.*

SPECIAL OFFER AT REDUCED PRICES.

NEW D.C. MOTORS.

All shunt wound, except Cromptons, which are all shunt interpole, and Siemens 20 H.P. and upwards are shunt interpole, and Higgs are shunt interpole.

Prices include slide rails and pulleys in every case.

Make.	No. in stock.	H.P.	Volts.	Speed.	Price.
G. E. C.	15	1	200/240	1000	£26
Do.	25	2	Do.	1050	£33
Do.	4	3	Do.	1250	£52
Do.	3	1½	Do.	1350	£28
Do.	1	1	400/480	1000	£33
Do.	2	2	Do.	1250	£35
Do.	1	7½	440/480	1400	£80
Siemens	3	4	220	1070	£66
Do.	2	4	440	1070	£70
Do.	3	5	220	1400	£70
Do.	4	5	440	1400	£70
Do.	2	4	220	770	£82
Do.	6	5	220	1000	£72
Do.	5	5	440	1000	£81
Do.	3	7½	480	1290	£80
Do.	3	7½	220	1320	£86
Do.	1	10	500	870	£120
Do.	4	10	440/480	1165	£100
Do.	6	10	440	870	£125
Do.	3	13½	220	1150	£127
Do.	2	13½	440	1150	£120
Do.	3	15	220	900	£154
Do.	2	15	440	900	£154
Do.	2	20	220	820	£181
Do.	2	20	440	820	£175
Do.	1	25	220	810	£210
Do.	1	25	440	810	£200
Do.	1	30	220	750	£240
Do.	1	30	440	750	£240
Do.	2	40	440	740	£281
Do.	1	54	440	710	£332
Do.	1	50	440	510	£382
Veritys	5	3	200/250	1200	£46
Do.	1	30	440	850	£200
Met.-Vickers ...	1	10	480	1000	£105
Do.	2	7½	460/480	910	£93
Do.	4	7½	480	1250	£80
Do.	1	16½	440	1130	£150
B. T. H. Co., Ltd. ...	1	1	100/110	1300	£26
Do.	2	5	200/250	1200	£65
Do.	3	10	480	1100	£102
Do.	1	12½	480	1010	£112
Do.	2	10	500	1140	£100
Do.	2	15	500	1035	£132
Do.	2	20	500	925	£162
Cromptons... ...	10	1	220	1600	£20
Do.	1	15	480	1000	£125
Do.	2	5	220	1150	£60
Do.	2	12½	480	1250	£100
Do.	3	10	480	1000	£100
Newtons	1	6	440	1200	£64
Do.	2	7½	480	1150	£68
Do.	2	12	480	1100	£90
Swedish Electric ...	2	4	440	1150	£50

NOTE.—Practically all of the above motors at 220 volts are suitable for use on 200/250 volts, and at 440 volts are suitable for use on 400/480 volts.

BERNARD MEGGITT, Engineer, Mansfield. Tel., 224. 2809

OLDFIELD ENGINEERING CO., LTD.

Hampson Street, Salford.

Telegrams: "Stalwart, Manchester."

D.C.

ONE Peebles Generator, 50-KW., 460 volts, 650 R.P.M., compound, interpole.

One Crompton Dynamo, 22-KW., 230 volts, 900 R.P.M., shunt, interpole.

One Mersey Motor, 25-B.H.P., 460 volts, 820 R.P.M., shunt, semi-enclosed, interpole, pulley, rails, starter, switch, &c.

One E.C.C. Motor, 8-B.H.P., 400 volts, 1,000 R.P.M., shunt, semi-enclosed, interpole, starter.

One Verity Motor, 3-B.H.P., 220 volts, 1,300 R.P.M., shunt, totally enclosed, starter, switch, and fuse.

Three new Siemens Motors, 1-B.H.P., 100 volts, 1,410 R.P.M., shunt, protected type, pulleys, rails, switches.

A.C.

One British Schukert Generator, 14½ amps., 1,100 volts, 1,000 R.P.M., 50 cycles, single-phase.

One Sandycroft Cascade Motor, 12-B.H.P., 220 volts, 3-phase, 50 cycles, 480 R.P.M., new, with liquid starter.

Two Ingleby Motors, 3-B.H.P., 400 volts, 3-phase, 50 cycles, 720 R.P.M., squirrel cage, pipe ventilated, pulleys, rails, T.P. switches.

Inquiries and inspection invited. All tested (in customer's presence, if desired), and despatched in first-class working order. 3268

FOR SALE.—*Continued.*

ELECTRICAL PLANT FOR SALE.

Government Surplus.

DIRECT CURRENT MOTORS, 220/250 VOLTS.

One	5 H.P.	550 R.P.M.	Shunt	£55
Two	7½ „	770/1400 „	„	110
Two	10 „	325/975 „	„	128
One	10 „	900 „	„	90
One	10 „	600 „	„	96
One	12 „	1000 „	„	94
One	12 „	750 „	„	138
Two	15 „	600 „	„	124
Four	15 „	300/900 „	„	160
One	15 „	880 „	„	128
One	16 „	400/1200 „	„	160
One	17 „	500/1500 „	„	150
One	20 „	1170 „	„	125
One	20 „	900 „	„	130
Four	20 „	325/975 „	„	210
Two	30 „	600 „	„	180
Two	30 „	300/900 „	„	240
Two	30 „	250/750 „	„	255
Two	35 „	350 „	„	180
Two	40 „	450 „	„	260
Two	50 „	450 „	„	315
Three	75 „	400 „	Compound	445
One	80 „	600 „	Shunt	390
Two	200 „	485 „	Compound	620

Most of above have Brookhirst Pillars.

DIRECT CURRENT MOTORS, 400/500 VOLTS.

One	5 H.P.	600 R.P.M.	Series	£78
One	10 „	600 „	„	130
Three	10 „	800 „	„	95
One	10 „	750 „	„	128
Four	12 „	300/900 „	„	136
One	12½ „	500/1000 „	„	138
One	15 „	350/1050 „	Compound	160
Three	20 „	900 „	„	124
Six	25 „	600 „	Shunt	180
Six	40 „	550 „	„	245
One	50 „	650 „	„	260
Six	55 „	500 „	„	294
One	150 „	370 „	„	650

THREE-PHASE MOTORS, 350/550 VOLTS, 50 CYCLES.

Four	5 H.P.,	710 R.P.M.	Squirrel	£60
One	10 „	940 „	Slip-ring	108
Two	20 „	710 „	„	170
Four	25 „	575 „	„	165
One	30 „	720 „	„	190
One	30 „	960 „	„	170
One	30 „	1440 „	„	155
Two	40 „	720 „	Squirrel	215
Two	50 „	960 „	Slip-ring	290
Six	75 „	480 „	„	415
Four	80 „	575 „	„	360
One	145 „	290 „	„	940
Two	150 „	485 „	„	850
One	220 „	364 „	„	1080

THREE-PHASE MOTORS, 400/440 VOLTS, 25 CYCLES.

Fourteen	25 H.P.	710 R.P.M.	Slip-ring	£210
Two	50 „	485 „	Squirrel	220
Ten	60 „	485 „	Slip-ring	360
Two	75 „	485 „	Squirrel	240
One	80 „	485 „	Slip-ring	395
One	160 „	720 „	„	590
Two	200 „	485 „	„	730
One	220 „	210 „	„	1050

All machines complete with control gear.

THE PHŒNIX ELECTRICAL CO., LTD.,

32/36, Broomielaw, Glasgow. 3976

FOR SALE OR HIRE.

NEW AND SECOND-HAND D.C. MOTORS.

¼-H.P., ½-H.P., ¾-H.P., 1½-H.P., 100/110 volt, speeds 1,600/1,700.

1-H.P., 3-H.P., 5-H.P., 7½-H.P., 10-H.P., 200/240 volt, speeds 700/1,400.

3-H.P., 5-H.P., 7½-H.P., 10-H.P., 20-H.P., 25-H.P., 400/440 volt, speeds 700/1,400.

The above are mostly by Siemens and Crompton.

A.C. MOTORS.

1½-H.P., 10-H.P., 15-H.P., 25-H.P., 3-phase, 415 volts, 50 period, 960 R.P.M., slip ring, with automatic starters. Brooks make.

3-H.P., 220 volt, single-phase, 50 cycles, slip ring, 1,400 R.P.M., Crypto make.

3½-KW., 220 volt, Siemens, 920 R.P.M., with regulator, D.C.

STOCKWELL & OHMS, LTD., 13, Penton Place, King's Cross, W.C. 1.

Telephone: 2650 North. 3196

FOR SALE.—*Continued.*

HUDSON'S ELECTRICAL ENGINEERING CO., LTD.

7 and 8, Prudential Buildings, Park Row, Leeds.

'Phone: 22792 — Telegrams: "Alternate" and "Boaz" Leeds.

SINGLE PHASE, SQUIRREL CAGE MOTORS IN STOCK.

Quantity	H.P.	Volts	Speed	Periods	
1	25	400	960	50	
1	5½	400	960	50	Slip-ring
1	3	200	960	50	
2	1	200	960	50	
1	2	230	960	50	
1	2	110	960	50	
1	3	100	960	50	
1	1½	105	1300	90	
1	1	105	1300	90	
1	6	220	1400	50	Slip-ring
1	5	200	1400	50	
1	2	200	1400	50	
1	20	400	1400	50	
1	12	400	1400	50	
1	5	110	1400	50	
1	1	100	1400	50	

Complete Pulley Rails and Starters.

THREE PHASE, SQUIRREL CAGE MOTORS IN STOCK.

Quantity	H.P.	Volts	Speed	Periods	
3	1½	440	1440	50	
1	2½	440	1440	50	
4	2½	440	1440	50	
4	2½	440	960	50	
1	3	440	960	50	
1	1½	440	960	50	
1	4	440	960	50	
1	4½	440	960	50	
6	1½	400	960	50	
1	1½	400	960	50	Slip-ring
1	12	400	1400	50	
1	4½	400	1400	50	
2	2½	346	1440	50	
1	4½	346	1440	50	
1	6	346	1440	50	
1	3	346	960	50	
1	3	346	960	50	
1	3	500	960	50	
1	10	220	960	50	
1	6½	220	1400	50	
1	1½	415	1400	50	
1	7½	220/380	1400	50	Slip-ring
1	7½	440	760	40	

Complete Pulley Rails and Starters.

TWO PHASE, SQUIRREL CAGE MOTORS IN STOCK.

Quantity	H.P.	Volts	Speed	Periods	
1	30	200	960	50	Slip-ring
1	5	200	960	50	
2	10	200	1400	50	
1	11	200	1400	50	
2	7½	200	1400	50	
4	4½	200	1400	50	
3	3	200	1400	50	
2	3	400	1400	50	
1	2½	200	1200	60	

All complete Pulley Rails and Starter.

D.C. MOTORS IN STOCK.

Quantity	H.P.	Volts	Speed	Remarks
3	16.5 KW.	100/110	2000	Compound Interpoles
4	5	230	1200	Shunt Interpoles
1	15	460/500	750	Compound Interpoles
1	15	500	890	Shunt Interpoles
3	40	460/500	1000	Shunt Interpoles
1	1.1 KW.	110	1400	Shunt Interpoles
1	25	220	700	Compound Interpoles
1	¼	220	700	Shunt Wound
4	5	480	1250	Shunt Interpoles
10	2	200/240	1350	Six-pole Shunt
10	1½	200/240	1350	Six-pole Shunt
5	1	200/240	750	Six-pole Shunt
10	2½	200/240	750	Six-pole Shunt
10	3½	200/240	1080	Six-pole Shunt
10	4½	200/240	1380	Six-pole Shunt

Complete Pulley Rails and Starters.

NEW.

We can give 14 days' delivery in dozen lots of the following special line of new Motors, all shunt wound, 6-pole, enclosed ventilated, mounted on ball bearings.

Stock windings for 100/130 volts:—

1-H.P., at 675 revs. — 2½-H.P., at 675 revs.
1½-H.P., at 1,020 revs. — 3-H.P., at 920 revs.
2½-H.P., at 1,500 revs. — 4½-H.P., at 1,380 revs.

Stock windings for 200/240 volts:—

1-H.P., at 750 revs. — 2½-H.P., at 750 revs.
1½-H.P., at 1,020 revs. — 3½-H.P., at 1,080 revs.
2-H.P., at 1,350 revs. — 4½-H.P., at 1,380 revs.

(Continued at top of next column.)

FOR SALE.—*Continued.*

(Continued from previous Column.)

Tenders wanted for the following steam generating sets, which will be loaded free on rail to buyer:—

One 200-KW. Brush Engineering Co., 500 volts, 120 lb., steam, 250 revs., 6-pole, compound wound Generator.

One 60-KW. Generating Set, Reavell Newton patent, compound engine, 120 lb. steam, Generator 60 KW., 500 volts.

The above new Motors are what we have continually in progress of manufacture, and same are sold as fast as completed.

An assortment of second-hand Dynamos and Motors always in stock.

Upwards of £30,000 worth always in hand.

ENGINE.

600-I.H.P. Willans patent triple expansion Engine, totally enclosed type, 160/200 lb. steam, equal to new. Would make ideal engine for mill or works drive. £360.

ALL GUARANTEED ONE YEAR. 9830

MACHINERY FOR SALE.

TURBO GENERATORS, A.C.

ONE 2,000-KW. Westinghouse, 3,300 volt, 50-period, 3-phase, new 1915, with surface condensing plant complete.

One 1,000-KW. Willans-Parsons E.C.C., 6,600 or 3,300-volt, 50-period, 3-phase, with surface condensing plant complete.

Two 1,000-KW. Westinghouse, 3,300 volt, 50-period, 3-phase, with surface condenser complete.

Two 750-KW. 525 volt, 50-period, 3-phase, makers A.E.G. Co., with two surface condensers.

Two 100-KW., 440 volts, 50 period, 3-phase, B.T.H.

Switchboard (brand new) for 460/550 volts, 50 period, 3-phase, by B.T.H. Co., 33 ft. long, all complete with latest type instruments; cost £1,800; all packed in 21 cases ready for despatch. Price £950 f.o.r.

GENERATING SETS, D.C.

One 300-KW. Paxman E.C.C., 460/580 volts.
One 300-KW. Belliss Dick-Kerr, 440/500 volts.
One 250-KW. Belliss-Silvertown, 440/500 volts.
One 150-KW. Belliss Fowler, 440/550 volts.

Four 150-KW. Belliss Houston, 220 volt, with surface condenser.

One 500-KW., 220 volt, low-pressure Turbine for running on exhaust from the above four 150-KW. sets, complete with the Blanc multiple jet condenser, also switchboard, piping, connections and spares. Will sell as a complete plant or separately.

Two 1-KW., 110-volt Robey-Electromotors, Ltd.

MOTORS, 440 VOLT D.C. AND A.C.

One 300-KW., compound wound, Westinghouse Motor or Generator, fitted with three bearings and 50 in. diam. rope pulley, speed 360 revs.

One 80-H.P., 440 volt, 50 period, 3-phase, enclosed ventilated, squirrel cage, by Crompton, 710 revs., complete with slide rails, pulley, oil-immersed auto starter.

One 50-H.P., D.C. Dick Kerr, 750 revs., with roller bearings.

One 40-H.P. Laurence-Scott, three-bearing Shunt Machines, with Igranic Pillar starter, 390 revs.

Six 40-H.P. J. P. Hall, equal to new, 550 revs.

One 25-H.P., by B.T.H., brand new, totally enclosed, 50 period, 3-phase, 585 revs.

Five 12-B.H.P. Ventilated shunt interpole, variable speed Motors, by Lancashire Dynamo Co., 300/900 revs., with B type oil-immersed Starters, by Brookhirst.

One 2-H.P., 50 period, 3-phase, by Canning, 1,300 revs.

MOTORS, 200/220 VOLT, D.C.

One 40-H.P. J. P. Hall, 660 revs., with three bearings.

One 48-KW. Generator or Motor, 550 revs., by J. P. Hall, fitted with three bearings.

Two 20-H.P., B.T.H., 780 revs.

Two 8-H.P. Mawdsley, 1,600 revs., with starter and slide rails.

Two 10 and one 12-H.P., Clarke Chapman, massive bi-polar, totally enclosed machines, suitable for working in a dusty atmosphere, speed 750/800 revs., with starter and rails.

One 3-H.P., by Union Co., 1,300 revs.
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One 1-H.P., McClure & Whitfield, 1,300 revs.

MOTORS, 110 VOLT, D.C.

Two 2-H.P., D.C., Verity, totally enclosed, 1,400 revs.

All the above are ready for immediate despatch, and they are all complete with starters, and in most cases slide rails.

Two A.E.G. Electric Welding Sets, 70 volts, 1,000 amps., 800 revs., equal to new.

One Electric Drilling Machine of Westminster Tool & Electric Co., 240 volts D.C., with 17 drills, 15/64 in. to ½ in. diam.

Three New Aron Clock Meters, 600 amps., 500 volts.

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Telephone: 1081 Edgbaston. Telegrams: Rotherwood, Birmingham. 2128

FOR SALE.—*Continued.*

NEW MOTORS AND GEARS, &c., IN STOCK.

A.C. MOTORS.

1, 2, 3, 4, 5, 7, 10, 12, and 15-H.P., squirrel cage.
12, 15, 18, 20, 25, 30, 40, 50, 60 .80. and 130-H.P. slip ring.
Two and three-phase, 220, 440, and 500 v., 25, 40, and 50 cycles.

D.C. MOTORS.

.5, 1, 2, 3, 5, 7, 9, 10, 12, 15, 18, 20. 25. 30. 40. 50. and 60-H.P. 200 to 550 volts.

All the above are complete with pulley slide rails, control and starting gear, air and oil cooled, with and without automatic features.

106 5 to 15-H.P. Star Delta, plain and with two overloads and one no-volt releases.

49 D.C. Starters, 2-H.P. to 40-H.P., double automatic.

165 D.P. Switch and Fuses, H.O. pattern, 10 to 75 amps.

Four 280 amp. Oil Circuit T.P. Breakers, two overloads, and one no-volt release.

Six Airbreak ditto, 15-50 amp.

CABLE.

CAB-TIRE SHEATHED, ASSOCIATION GRADE, 600 MEGH.

5,000 yards 1/18, 3/22, 3/20, 7/22, 7/20 twin.
100 yards 37/14, 83 yards 19/16, 62 yards 61/19/26 flexible.
30 yards 37/12, 128 yards 19/17.

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17,000 yards 1/18, 3/22, 3/20, 7/22, 7/18, 7/20, 7/16, 19/16, and 19/14.
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All the above materials are in stock for immediate delivery. The reason of our advert.: We wish to solicit your kind attention. You may require what we wish to send you. Wire, telephone, or write us *please*. We shall move quickly.

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Telegrams: "Robust, Walsall." Telephone: 512 Walsall.
3952

FOR SALE.

DIRECT CURRENT ELECTRIC MOTORS.

No.	H.P.	Volts	R.P.M.	Maker
3	12	210	1,400	B.T.H.
1	10	100	825	Mawdsleys.
1	5	200	2,420	B.T.H.
1	4½	110	1,430	City Electrical
1	2½	220	550	Crompton.
1	2	220	1,180	Crompton.
1	2	220	1,400	Mawdsleys.

One new 3½-KW. Generator, by City Electrical Co., 110 volts, D.C., 32 amps., 1,430 R.P.M., with Switchboard.

One 2-KW. Petrol-driven Generator, set by Keighley Gas and Oil Engine Co., 105 volts, 20 amps., 750 R.P.M.

One 55-B.H.P. Crossley Gas Engine, No. 78,102, with Suction Plant for burning wood refuse. Can be seen running.

STANLEY ENGINEERING Co., Bath. 3872

FOR SALE.

Generating Sets which can be arranged to run on petrol, paraffin or gas.

No. in Stock.	Make.	Output.	
1	F.W.	50 volts,	10 amps.
6	Austin	110 ,,	32 ,,
2	,,	110 ,,	41 ,,
1	,,	80 ,,	100 ,,
1	Parsons	110/120 ,,	67 ,,
1	F.W.	100 ,,	100 ,,
1	Barlow	100 ,,	100 ,,
1	John-Vickers	60 ,,	50 ,,

1 450-gallon Oil Fuel Tank, ¼ plate, rivetted complete with manhole, cock, &c.

Sets up to 50 KW. in stock

Write for further particulars, to—

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FOR SALE.

MOTOR GENERATOR, E.C.C., Motor 500 volts, output 250 amps., 10 volts, enclosed switchgear.

Dynamo, Siemens, 5-KW., 1,450 R.P.M., 110 volts.

Motors (2), Crompton, 410 volts, 1,150 R.P.M., with pulley, &c.

Motor, Phœnix, 20 H.P., 220 volts, 1,170 R.P.M., with switchgear.

Motor, Mawdsley, 18 H.P., 220 volts, 920 R.P.M., new condition.

Motor, Mawdsley, 21 H.P., 800 R.P.M., 440 volts, new condition.

FYFE, WILSON & Co., 31, Budge Row, E.C. 4.
4062

FOR SALE.—*Continued.*

STARTLING OFFER.

NEW ELECTRIC LAMPS, ETC.

Osram or Mazda makes, ordinary Bayonet Cap, metal Filament.				50% off List.
53,000	Lamps	110 Volts	20 Watts.	
7,000	,,	120 ,,	20 ,,	
Osram make with Edison Screw Cap Metal Filament.				60% off List.
9,843	Lamps	220 Volts	20 Watts.	
404	,,	220 ,,	60 ,,	
380	,,	220 ,,	100 ,,	
5,833	,,	110 ,,	20 ,,	
5,650	,,	110 ,,	40 ,,	
1,900	,,	125 ,,	40 ,,	
250	,,	110 ,,	60 ,,	
Mazda make, Gas Filled, Half-Watt Type.				42½% off List.
4,000	Lamps	110 Volts	100 Watts.	
100	,,	125 ,,	200 ,,	
35	,,	120 ,,	500 ,,	

Dutch make, ordinary Bayonet Cap, Metal Filament.
1,000 Lamps 115 Volts 25 C.P. 1s. each.

Special quotations for large quantities or export; over 30,000 sold last week.

Also 200 miles of 3/22 Rubber Insulated, Doubly Taped.

600 Megohm Cable, Henley's and Callender's make, at £13 per mile.

On drums 880 yds. Black, or 440 yds. each Red and Black.

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5,000 English Porcelain 2 pin, 5 amp. Wall Plugs, at 20s. doz.

150,000 pairs ⅛, 3/16, ¼ Double Grove English Porcelain Cleats, 7s. gross pair.

2,000 Ornamental Pines, 2s. 9d. each, cost double.

All the above are guaranteed new as from the makers, and ready for immediate delivery, f.o.r. or London limits.

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Several Branches. Established 1890.

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FOR SALE.

FOR SALE, 50-H.P., 440 volt, 3-phase, 40 cycle Bruce Peebles Motors, 760 revs., with Ellison Starters.

Plating Dynamo, 6 volts, 340 amps., by Scott & Mountain.

3-KW. Crompton Converter, 460/60 volts.

15 and 22-H.P., 220 volt, D.C. Motors, with Brook Hirst Starting Panels.

100/120 volt, 110 amps., shunt wound bi-polar Dynamo, with ring oiled bearings.

DRUMMOND & Co., Middlesbrough. 321

FOR SALE.

GAEDE PUMPS.

SEVEN for disposal, also one or two with a few parts missing. Would sell singly or an offer for the lot would be considered.

GERYK PUMPS.

(Fleuss's Patents). Five for disposal, suitable for backing Gaede Pumps advertised above. In very good condition. Diameter of cylinder 2 in., stroke 4 in.

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THREE only Sets Electric Tangye Pumps, capacity each 20,000 gallons of water per hour against a total "head" of 120 ft., complete with 25-H.P., 500 volt, D.C. Motors, and full controlling gear. Location London. Immediately available.

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FOR SALE.—*Continued.*

FOR SALE.

DIESEL ENGINES, six cylinder, two and four stroke, 850, 1,000, 1,200 H.P., excellent condition Dynamos for above 250 or 500 volts D.C. Immediate delivery and low price.

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Electrically-driven Air Compressors, 250 volts, D.C., pressures 1,500 to 3,000 lb. per sq. in.

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CRANE OR HOIST MOTORS.

TWO 8-B.H.P. Hall's totally enclosed Motors, 440 volts, D.C., 940 R.P.M., series wound, with controllers and resistances. New condition.

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DIRECT coupled Steam Generating Sets.
One 24-H.P., 105 volts, D.C., 535 R.P.M.
Two 32-H.P., 205 volts, D.C., 500 R.P.M.

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Buy right and sell right.
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Absolutely square both ways.
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30-KW. Holmes Generator, 230 volt, 130 amps., 860 R.P.M., shunt wound, pulley, slide rails, shunt regulator. £225, new condition, guaranteed perfect.

Six 3½-KW. new B.T.H. Dynamos, 110 volts, 1,430 R.P.M., 31.8 amps., compound wound, pulley and shunt regulator. £47 10s. each.

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220 volt, direct current, shunt wound Motors, by Sunderland Forge Co., in excellent condition.

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Two 340-KW., 500 volt, direct current Diesel Sets, by Mirrlees, Bickerton & Day-Crompton, 1918, complete with switchboard, electric and petrol motor-driven Compressors, Pumps, Overhead Travelling Crane, Spares, &c.

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BROOK-HIRST Motor Starters, enclosed, glazed fronts, complete with no-volt release, trip switch, hand wheel, &c. Brand new. 200 volts, 3 H.P. £5 each. 110 volts, 1 H.P. £4 each. Immediate delivery.

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230 volt Boothroyd D.C., 1-H.P., 750 R.P.M., compound wound Motor, with half coupling. Quite new. £33.

Two-cylinder Air Compressors, 2 in. by 4 in., with reduction gear on bedplate. £15.

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400 gross pairs 2-way Cleats, 1⅜ in. long, ¼ in. grooves. Quantities only supplied. 10s. per gross pairs. (Subject to trade discount.)

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CARBONS, flame arc, for Sale.—Samples from Borough Electrical Engineer, St. Peter's Chambers, Stoke-on-Trent. 4025

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COTTON-Covered Wires.—Tons per week manufactured by the Eastcombe Engineering and Trading Co., 35, Eastcombe Avenue, Charlton, S.E. 7. Orders and enquiries invited. 382

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CROMPTONS 1-H.P. New Motors, with pulleys, 220 volts, 1600 revs., £20.—Bernard Meggitt, Engineer, Mansfield. Tel. 224. 3031

DUTCH Gas-filled Lamps (½-watt type), 30/100 watts, high voltage and low voltage. Also ordinary trade enquiries invited. — London Factors and Agents, Ltd., 38, Parliament Street, S.W. 1. 3582

DYNAMOS, 50 v., 12 a., 1000 R.P.M., shunt wound, by the G.E.C., £15 each, nearly new.—White, 140, Southwark Street. 284

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ELECTRIC Motors, best makes, two 50-H.P., second-hand; 50-H.P., new.—To view, apply Dairy Supply Co., Ltd., Museum Street, London, W.C.1. 410

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FOR Sale, complete Small Power Station of 200 KW. capacity, 500 volts, D.C., and comprising three National gas engines, with direct coupled generators, producer plants, switchboard, &c.; plant seven years old. Reason for sale, taking supply from power company.—3677, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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FOR Sale, four 25-H.P., 350-volt, 50-cycle, 575-R.P.M., 3-phase, slip-ring motors, complete. £145 each. — The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 4053

FOR Sale, Medical Coils (all descriptions), bells, switches, toy motors, miniature lampholders, circular resistances. Send for samples.—Allen & Parkes, 15, Summer Row, Birmingham. 3501

FOR Sale, Motor-Generator, 20 H.P., 500-volt, D.C. motor coupled to 6-volt, 2000-ampere generator, also smaller ditto, 12 H.P., 500 volts to 6 volts, 1000 amperes.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 2346

FOR Sale, nearly new, 800 KW., 460-volt, D.C. Turbo Set, with condenser, &c., complete.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 3678

FOR SALE.—New 25-period, 3-phase, 375 R.P.M., Motors, by Siemens—500-H.P. and 250-H.P., 5000/5500 volts; 150-H.P., 440 volts; all slip-ring, with brush-lifting and short-circuiting device, and complete with starting gear. — 4020, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale or Hire, Motors and Dynamos, 440, 220, 110 volts; Electrical Machinery of all kinds.—W. W. Martin, 320, Witton Road, Birmingham. Phone: East 883. 1470

FOR Sale, slip-ring Motors, 50-period, 3-phase, 440 volts, 710 R.P.M., E.C.C., with brush-lifting device and starting gear; in perfect condition. 6-H.P. pipe-ventilated, £78; 1½-H.P., totally-enclosed, £35.—3897, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, two nearly new 20-H.P., 200-volt, 50-cycle, 2-phase, slip-ring Motors, complete. £130 each. — The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 4052

FOR Sale, two 35-B.H.P., 950 R.P.M., 500-volt, compound-wound, interpole Motors, by Phœnix Dynamo Co., £130 each.—3685, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, two 100-B.H.P., protected-type, slip-ring Motors, fitted with brush-lifting and short-circuiting device, wound for 220 volts, 50 periods, single-phase, 950 R.P.M., with belt pulley, 21" dia. by 18" face, with protected-type stator starter, and protected-type rotor switch and resistances, oil immersed, and slide rails and holding-down bolts.—9538, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.—*Continued.*

FOR Sale, 110-KW., 480-volt, 400 R.P.M., shunt-wound, 3-bearing Generator, by Bruce Peebles & Co., with rails, spare armature, field coils and bearing brasses.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 2946

FOR Sale, 500-volt. D.C. Motors, 35-H.P. brush shunt, interpole protected, 630 R.P.M., £150; 5 H.P., Mavor & Coulson, totally enclosed shunt, 1000 R.P.M., £40. — 4047, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOUR 97-H.P., 6-pole, shunt-wound Dynamos, 460/560 volts D.C., 130/160 amps., 260 R.P.M., with bare shaft for belt or rope pulley, or can be coupled direct to engine.—Western Engineering Co., Swansea. 967

GLUE Pots (2 pint), Belling make, 100/110, 200/220 v. (new) complete. 50s. each.—Edwardes Bros., 20, Blackfriars Road, S.E. 1. 430

LALLEY 1-KW. Lighting Set. In perfect running order. Only been in use two months. Price £110.—Besley, Bailey & Co., Hope Street Lane Works, Cardiff. 3972

LARGE quantity 1½-in. circ. Galvanised 6/24 Flex. Steel Wire Rope, in 300-ft. lengths, 25s. per length.—3390, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LATEST type 1050-KW. Turbo-Generator (low pressure) and Condensing Plant, 50 periods, 3-phase, 6000 volts. Asynchronous squirrel-cage Rotor, contraflo condenser, by Richardson Westgarth, complete with all accessories, including switchgear; two identical sets available.—Harry H. Gardam & Co., Ltd., Staines. 2836

LISTER-Bruston Automatic Electric Lighting Plant, 6-KW., type H, 600 R.P.M., 110 v., complete with 54 cells and switchboard. First-class order. Can be seen running Gloucestershire.—3828, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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MOTORS, A.C. and D.C., from stock, 1 H.P. to 40 H.P. Good prices.—3903, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

NEW Motors and Starters. Cheapest firm on earth. Try us.—Cunningham Limited, 171, Edgware Road, W. 2. 640

NEW. — One motor-driven, two-stage Air Compressor, by Tilghmna, cylinders 18" diam., capacity about 600 ft. per minute, at 120 lbs. pressure; motor, 145 B.H.P., 50 cycles, 3-phase, 440 volts, 290 revs., complete with switchgear.—Harry H. Gardam and Co., Ltd., Staines. 3235

ONE Alley & MacLellan Steam Generating Set, direct-coupled Lancashire Dynamo, 200 KW., 500 volts, 6 poles, 470 R.P.M.; steam pressure 180 lbs.—3386, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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ONE Fielding & Platt horizontal, tandem, 2-crank, Gas Engine, 180 B.H.P., direct-coupled Crompton, 100 KW., 500 volts, D.C., 180 R.P.M., 6-pole generator; complete with gas plant, air compressor, &c.; magneto ignition.—3387, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ONE Suction Producer Plant, by Hopkinson, Huddersfield, complete, and suitable for 100-H.P. gas engine.—Western Engineering Co., Swansea. 968

ONE 70-H.P., 585 R.P.M., and two 40-H.P., 481 R.P.M., A.C. Motors, three-phase, 25 cycles, 400/440 volts, totally enclosed, slip-ring type. "Peebles," brand new machines.—3389, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PORTABLE Oil Furnaces save money for garages, plumbers, fitters, tinsmiths, builders, &c. We offer as bargains balance of American Army stock, new and perfect, substantial W.I. frame, 7-pint brass container, well-made lamp, and 7-in. C.I. melting pot at half present day selling price, while stock lasts.—Write for particulars, Parker, Winder & Achurch, Ltd., Birmingham. 3190

QUANTITY Electric Bulbs for disposal; carbon filament, open terminals, would clear very cheap.—Write, Lewis, 125, Park Lane, Stoke Newington, London. 411

FOR SALE.—*Continued.*

REVO Electric Fire, 4 bar, 230/250 volts, 2 KW., with 15 feet of flexible. Excellent condition, 45s.—Croker, 8, Ashburton Road, Southsea. 437

SALE.—10-B.H.P. Motor, D.C., 460 volts, by James Tate, Bradford. Slide plate and starter. Guaranteed perfect order, £80. Also 1½-B.H.P., Series Wound, 1000 revs., 220 volts, ball bearings. Good value, £20.—Spaven & Preston, 53, George Street, Bradford. 396

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SITUATIONS VACANT.—*Continued.*

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DRAUGHTSMAN, experienced, required by large industrial concern in Glasgow, with first-class experience in lay-out of modern turbine installations and boiler-houses.—Applications to state age, where employed, details of experience and salary required. —4012, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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ELECTRICAL Instruments.—Wanted by Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, qualified men for calibrating (*a*) Instruments and (*b*) Meters, in the Works Test Room, and also for (*c*) checking Instruments and Meters after installation. Technically trained men used to polyphase work preferred.—Apply in first instance by letter, stating age, experience and salary required, to Employment Department. 3978

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FITTER-Driver and Engine-Driver required by electricity supply undertaking in the Midlands. Wages 1/9½ and 1/7½. Permanency to suitable men.—Applications, stating age, married or single, past experience and copies of references, to 402, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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FOREMAN'S Assistant required in Winding Shop of electrical engineering firm; young single man required with personality and experience of A.C. work. Good prospects to suitable man.—Apply, giving full particulars regarding experience, &c, to 4024, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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ORDER Department.—Electrical firm (Manchester district) requires Assistant Departmental Manager to take charge of departments dealing with incoming orders, progress through factory and despatching sections. Applicants should possess technical (electrical) knowledge, coupled with thorough experience in office routine and controlling staffs. Willingness to deal personally with detail essential. State experience, age, references and salary. —3964, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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WANTED immediately, Junior Shift Engineer (London district) with sound training and experience. Low tension continuous current and high tension alternating.—Apply, stating age, experience and salary required, to 4056, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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WANTED, three Electrical Engineers, single, age 23 to 25, of good appearance and well educated, to run storage battery depôts at home and abroad. Technical and practical experience of electric plant essential, also preferably knowledge of batteries. Salary, £200 to £300.—Apply, giving particulars of experience and endorsing copies of testimonials, to 4033, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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AN efficient Electrician, skilled in erection of lifts, switchboards, theatre lighting, cinema apparatus, automatic control, power or domestic wiring installations. Reliable man for reliable work.—Batten, 15, Church Road, Kingston, Surrey. 372

AN Electrical and Mechanical Engineer (34) wishes appointment, ex-officer, University education, A.M.I.E.E., formerly municipal electrical engineer of important town. Excellent all-round commercial and technical experience.—362, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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ELECTRICIAN (disengaged), constructional or maintenance, lighting (all systems), A.C., D.C. motors, automobile lighting and starting magnetos, workshop tests.—H. G., 6, Listria Park, Stoke Newington, London. 392

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WIREMAN wants job, any system.—Robinson, 5, Agincourt Hampstead, N.W. 432

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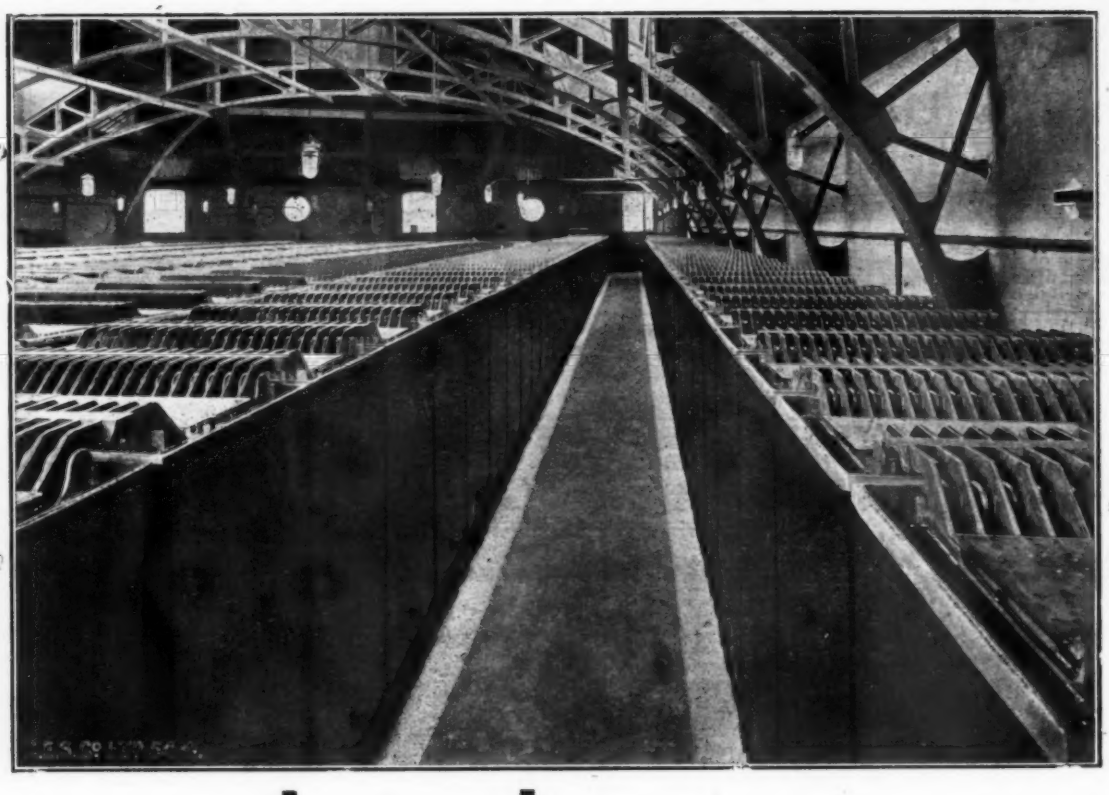

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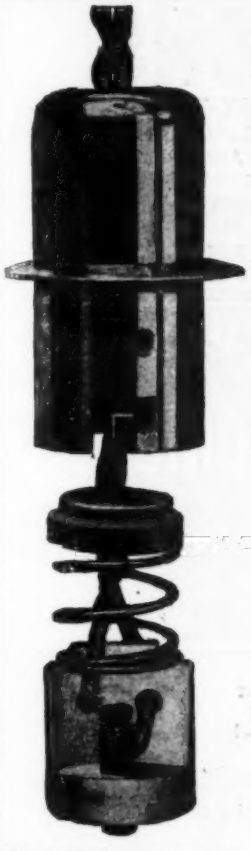

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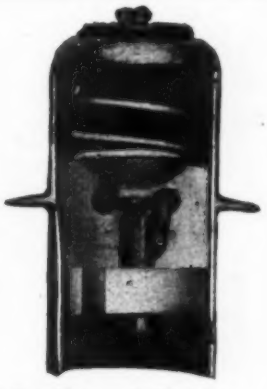

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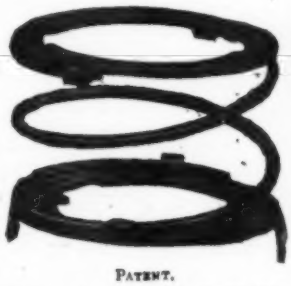

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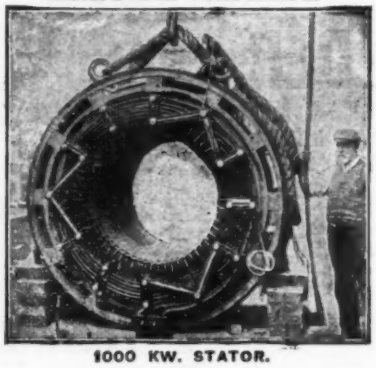

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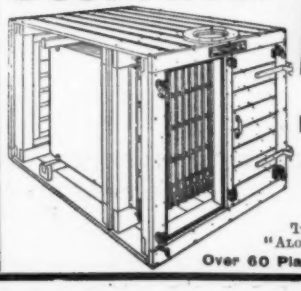

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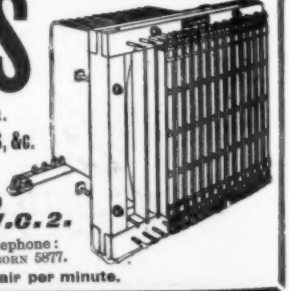

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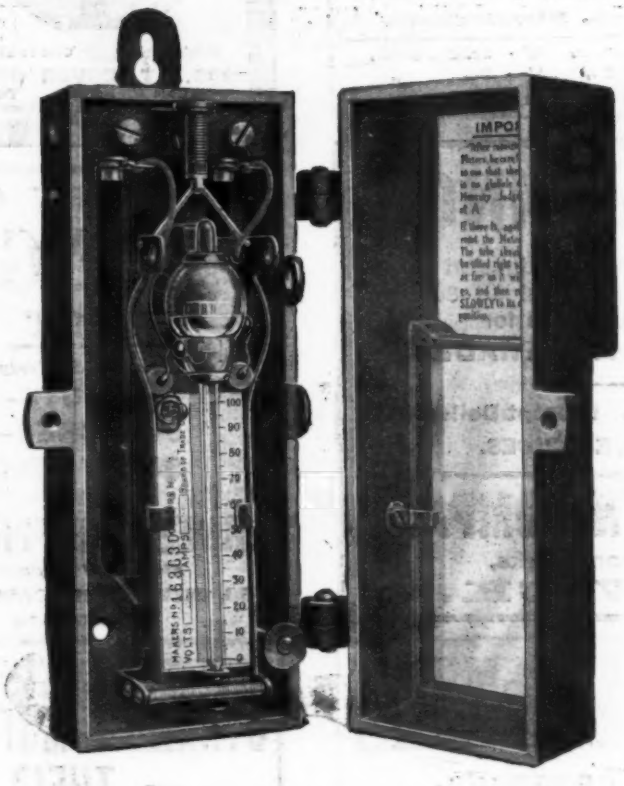

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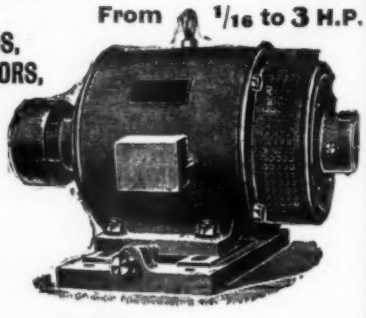

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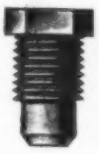

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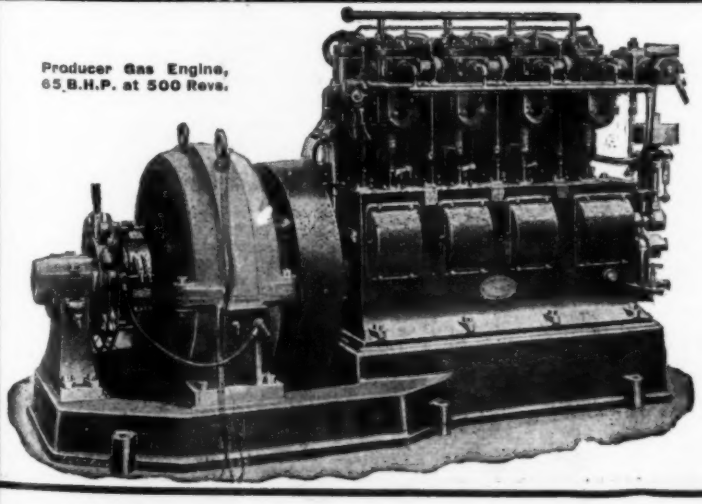

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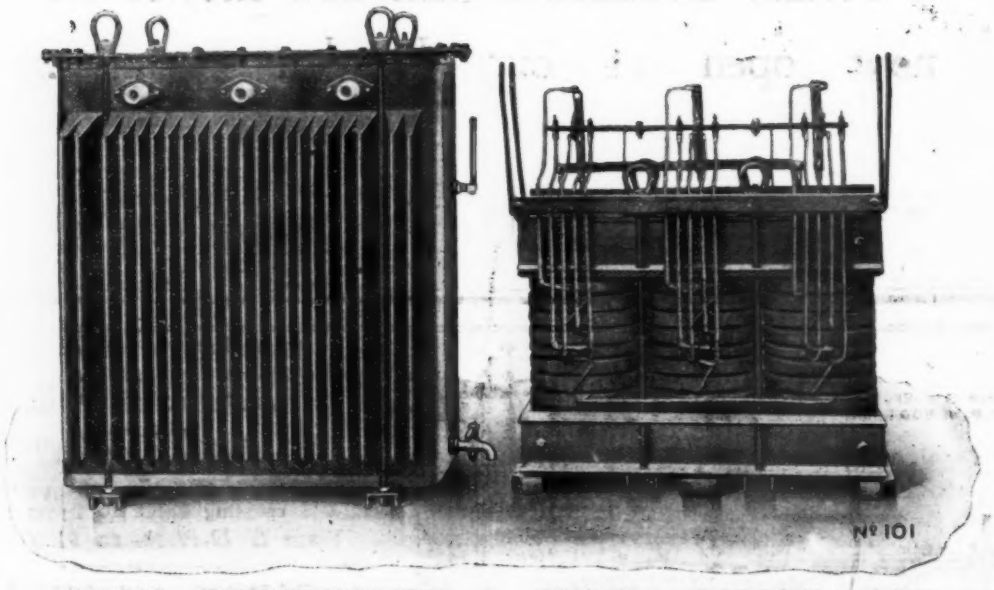

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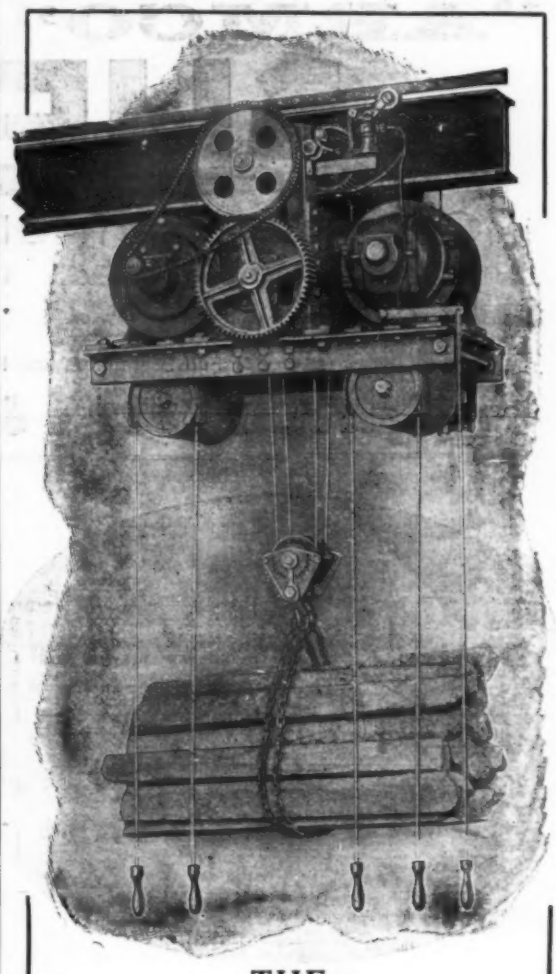

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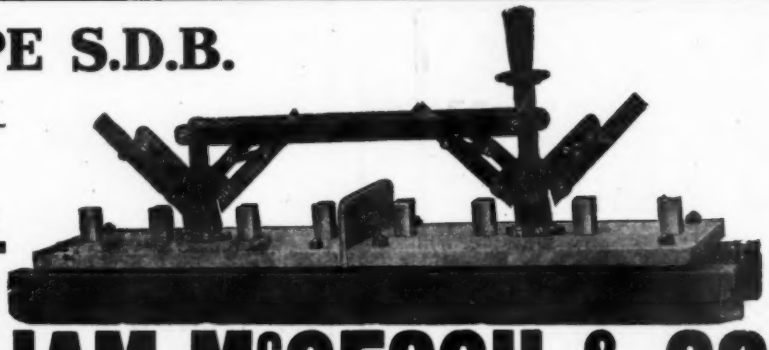

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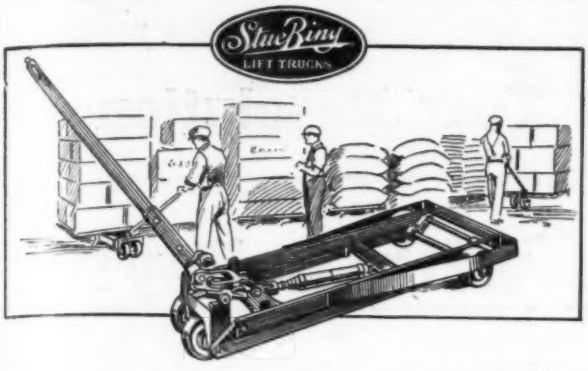

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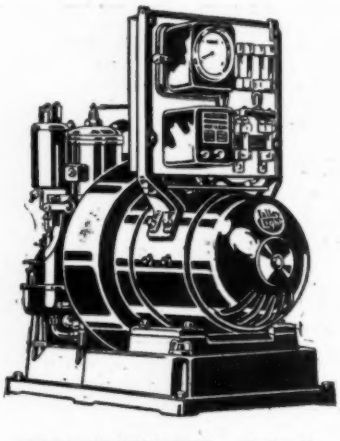

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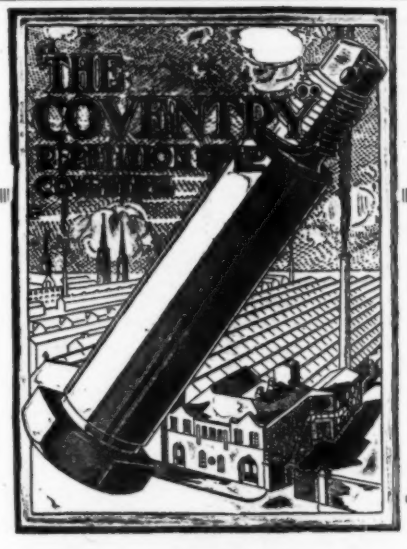

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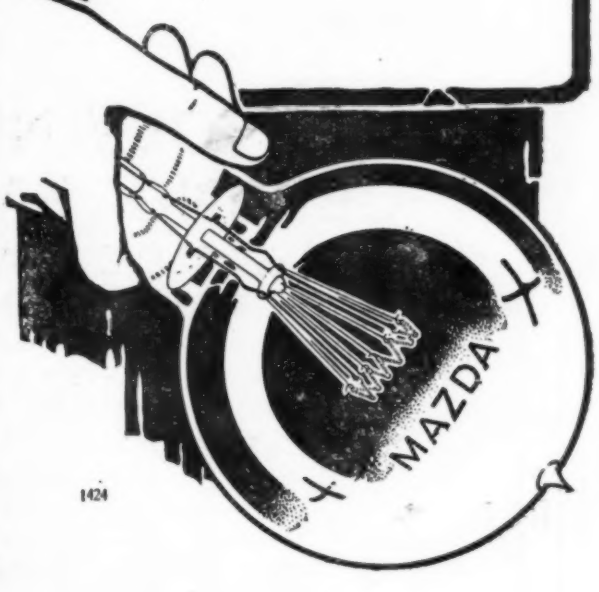

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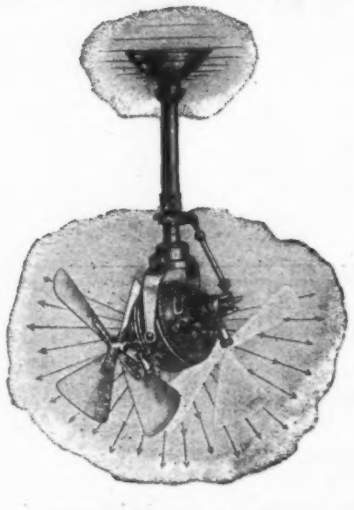

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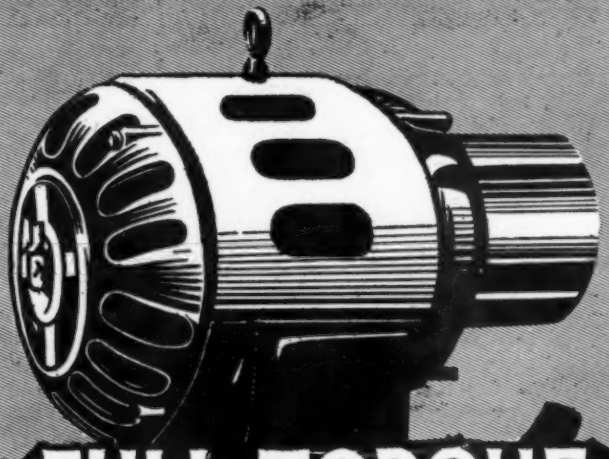

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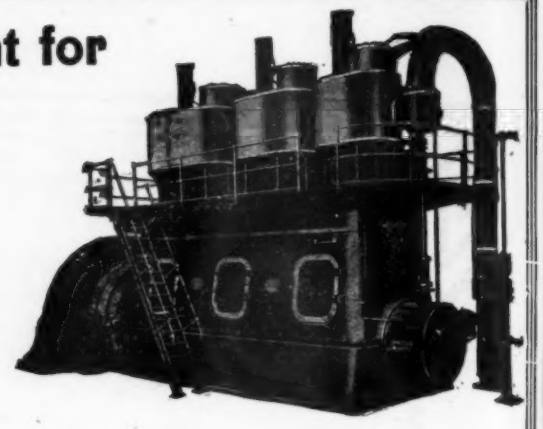

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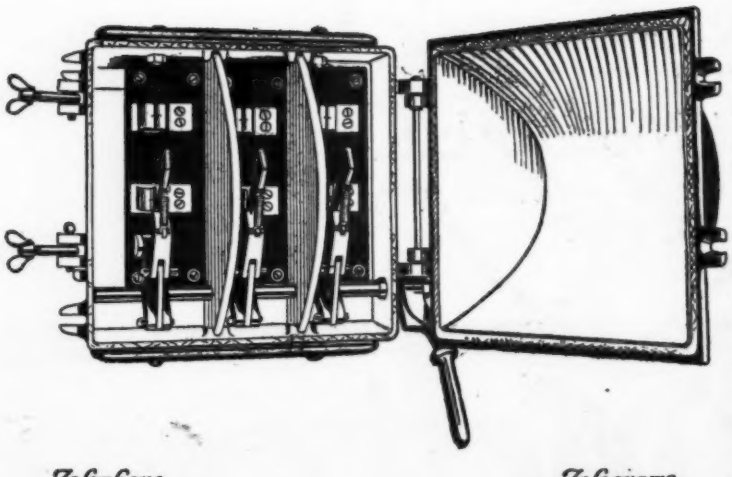

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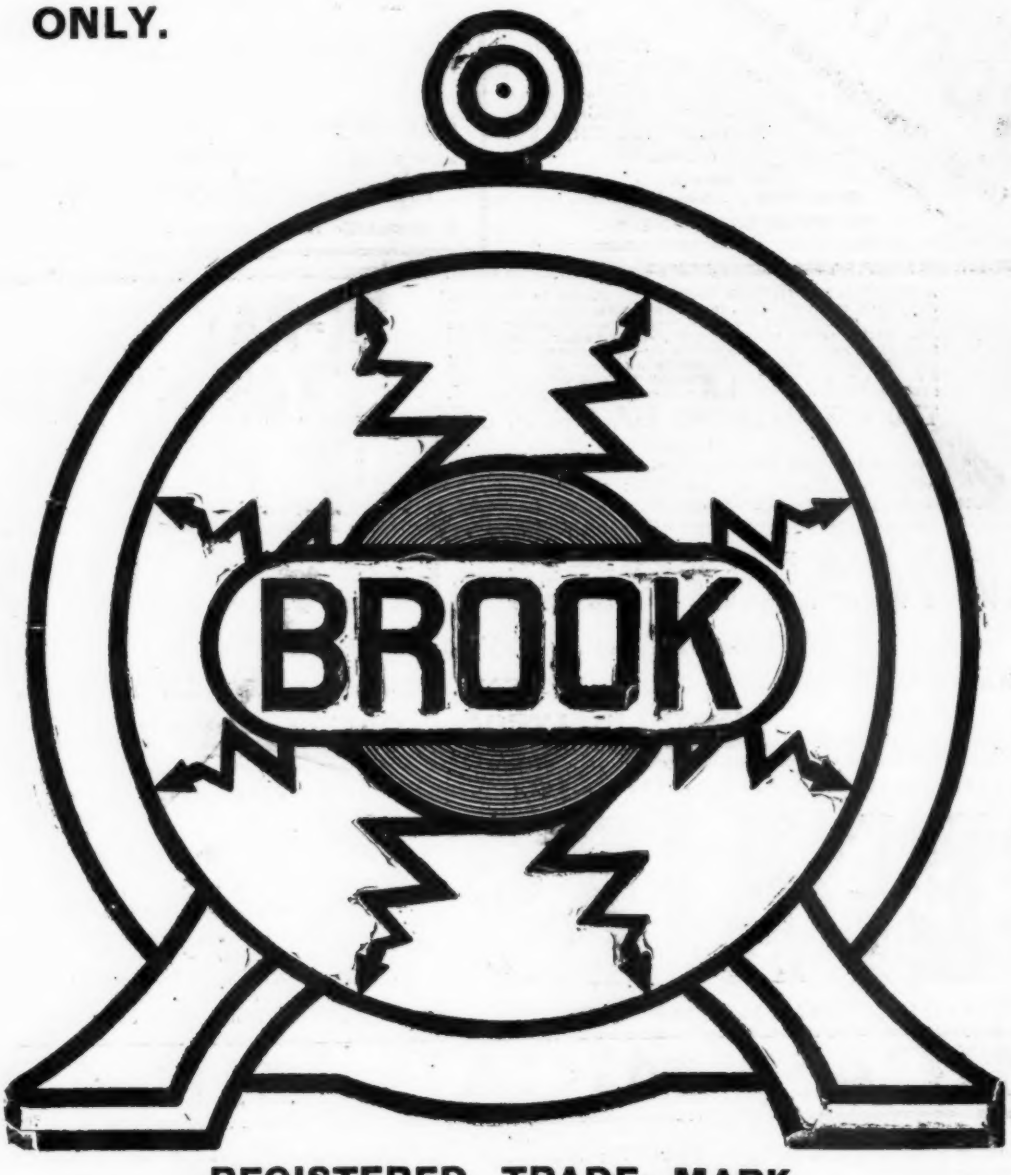

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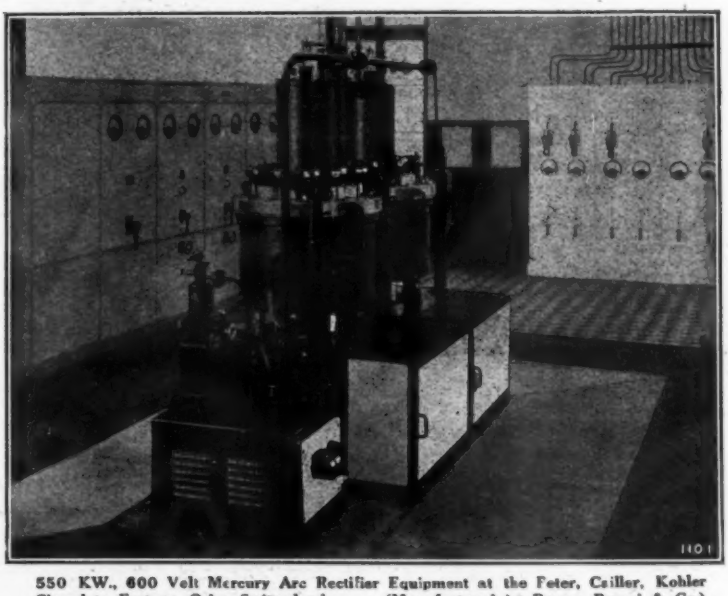

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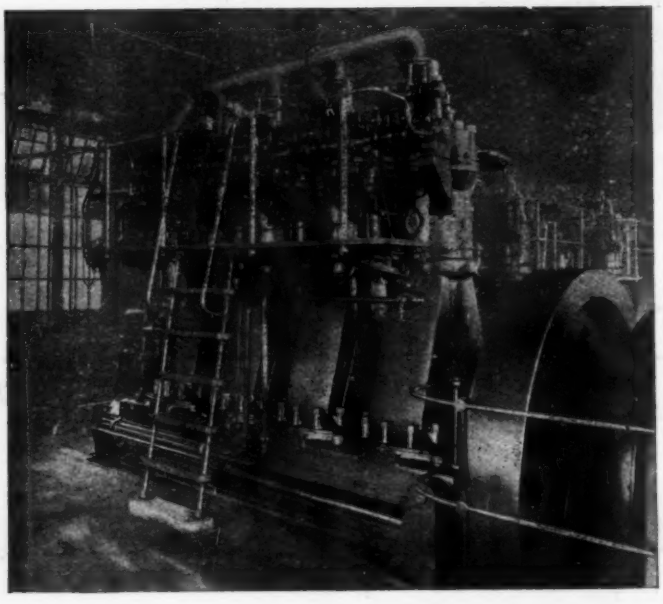

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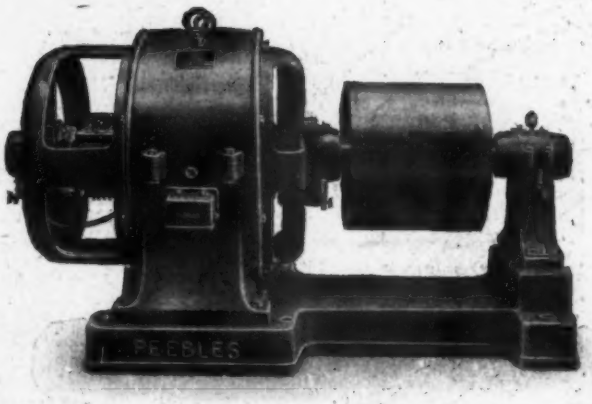

2267

Peebles 150-B.H.P. Protected Type D.C. Motor with outer bearing and bedplate.

PEEBLES

Silvertown

LECLANCHÉ CELLS

(POROUS POT FORM)

WE have been manufacturing Leclanché Cells for nearly half a century. As the original makers in this country our experience of this class of work is unique.

To-day Silvertown Leclanché Cells are better than ever—partly because we use only the highest grade of manganese-peroxide and zinc—mainly due to a recent discovery of ours in the manufacture of charged pots, which adds considerably to their efficiency and durability.

Every Silvertown Porous Pot is made under these improved conditions.

Extended tests conducted by us preclude any possibility of faulty cells leaving the Works.

We make all types of Primary Batteries. Write for List No. 31.

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